ELECTRICAL REVIEW

4th JANUARY 1952

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Prospect for 1952

THE past year was not an easy one for industrialists. Re-armament needs began to make their effects felt and the country's balance of overseas payments and trade took a more or less sudden turn for the worse. There was no lack of work for the engineering industry as a whole and the electrical branch continued to work at a pressure limited only by shortages of materials and skilled labour.

Shortages were largely the result of "stockpiling" or the diversion of materials for defence purposes and it is unlikely that the position will improve this year even though limitation of armaments is under discussion.

Restrictions on capital expenditure are already hampering the activities of many manufacturers and the screw is tightening. There is a limit to the financing of development from current surplus which, in fact, is generally sufficient only to cover the increased cost of carrying adequate stocks. Fresh capital is badly needed by a number of electrical concerns.

Certainly, many drastic adjustments will have to be made in our economy to ensure that available resources are applied to the best effect. In the matter of materials a beginning has already been made. Prohibitions have been placed upon the use of certain metals for what are considered to be non-essential uses and next month a system of steel allocation comes into force after being postponed from December.

Such adjustments should have a beneficial effect upon most branches of electrical manufacturing if those responsible fully realize the basic nature of the industry. Not only must it provide the plant to produce electrical energy and electrical equipment for multitudinous industrial applications, it is also expected to contribute substantially to the country's overseas trade. In the first eleven months of 1951 electrical exports totalled £150 million (compared with £127 million in the corresponding period of 1950).

It is to be hoped that while industrial needs are being catered for there will still be some allocation of materials for domestic electrical appliances. There are many other directions in which economy can be achieved less harmfully. The idea that all these appliances are unessential is quite false.

Our principal task during the coming year will be to back the endeavours of the industry's representatives to secure a fair deal for all branches in the face of a not altogether disinterested opposition.

ATOMIC ELECTRICITY

The announcement made last week-end, which is referred to on another page, that shortly before Christmas atomic energy was employed, for the first time, in the United States to produce, indirectly, a useful amount of electricity marks another milestone in the historical development of our industry. The experiment lasted an hour and was purely exploratory. It was not in any way intended to show whether or not this new source of electricity might be economic. The experiment was performed " regardless of cost " in order to indicate the behaviour of molten metal as an evaporator of water into steam under particular conditions. It may be regarded as a valuable pointer to future procedure in research of this kind.

AMERICAN PRODUCTION

While there are powerful influences in this country which regard the generating plant expansion programme of the British Electricity Authority with misgiving, if not hostility, the United States electricity supply industry is uninhibited. In the next two years manufacturers of power plant are expected to increase their output by 51 per cent, while the actual installed capacity rises by 40 per cent, to meet the demands of industry, atomic energy development and re-armament. The increase in the overall output of electrical equipment by 1954, forecast by the National Electrical Manufacturers' Association, is 18 per cent.

FAIR DISTRIBUTION

Many of the smaller American manufacturing concerns are complaining that armament orders are going to too great an extent to the largest firms. It is said that in the year ended 30th June last about 62 per cent of the main contracts went to the hundred largest firms, although it is fair to say that these must have sub-contracted some of the work to smaller units. Similar complaints were heard here during the war and an endeavour was then made to spread the work more evenly. No doubt the Departments responsible for placing contracts find it easier to deal with the bigger concerns, but it is desirable to ensure that rearmament work, to which an appreciable proportion of normal activities will have to give way, is shared out as fairly as possible.

WIDER INTERESTS

Recent correspondence in *The Times* has again raised the question whether engineers should be more " liberally " educated to fit them for administration. Professor E. G. Cullwick (University College, Dundee), who opened the subject, agreed that in the newer industries, such as electrical manufacturing, many in administrative positions had worked up through the technical ranks and he was speaking of general tendencies when he said that we had a long way to go before we reached the position attained in North America. There it was found that professionally educated and trained engineers and technologists were taking their full share not only in the direction and administration of industry but also in the public life of the nation as a whole.

Continuous Electro-Galvanizing

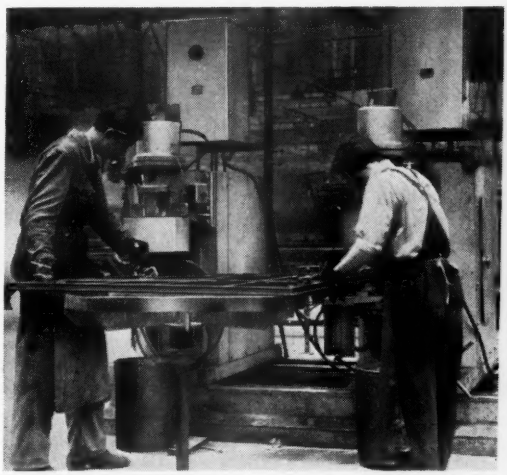
Large Scale Plant for Steel Window Frames

WHAT is believed to be the largest continuous electro-galvanizing plant in the world has recently been brought into operation at Hamilton, Lanarkshire, by Maclean & Co. (Metal Windows), Ltd. Designed and manufactured by the Electro-Chemical Engineering Co., Ltd., Weybridge, to electro-galvanize and phosphate steel window frames as a protective measure preparatory to stove painting, the plant is 303ft long, 27ft high and 12ft wide, with four tracks. Each jig bar can carry a load of 100 lb, making a total load of 400 lb per set of four. In the course of a 48 hr week (at present work is done at night to comply with load shedding requirements) it is possible to treat 2,500 frames of up to 10ft by 5ft and once the frames have been loaded on to the racks they are cleaned, pickled, plated and phosphated without being touched by hand.

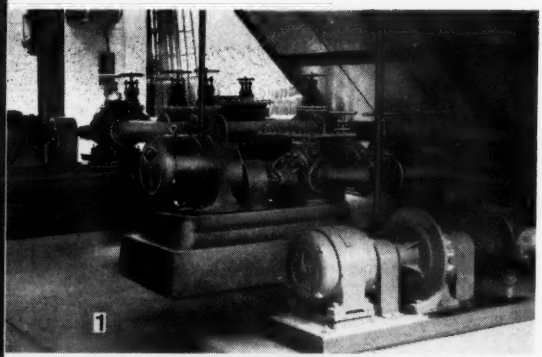
The window frames to be treated are constructed of Z-section mild steel which is cut, trimmed and welded together by means of a variety of electrical apparatus, including power presses; grinders; drills; spot, butt, stitch and jib welders. Passage of the frames through the plating plant is entirely automatic, the length of immersion and the sequence and frequency of operation being all pre-set by a cam type rotary controller and Venner time switch. The stage of operations reached can be seen at a glance in the control room on an illuminated indicator board.

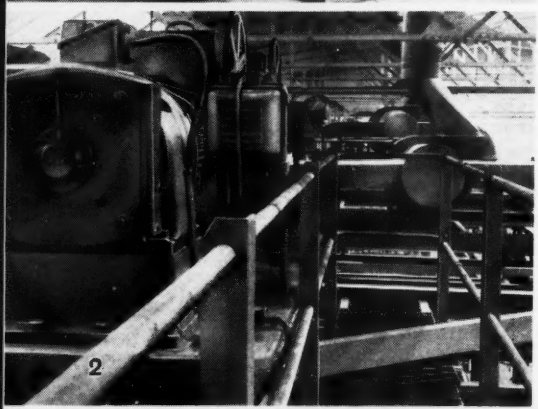
The frames, held on jigs designed to fit them exactly so that no part is unsupported, are fed into the plant by means of a specially designed truck which runs on a track at right angles to the plating line. While the truck is being loaded an interlocking switch prevents the next lifting movement until the truck is replaced. An aluminium bar carrying the jig hooks is brought forward on the return rail to receive the frames and is then rolled along one of two exactly aligned rails on to the truck, automatic solenoid operated stops preventing the bar from being pulled off the rail until the truck is stationed ready to receive it. When loaded the truck is pushed back into position in the plating plant where the work is weighed to ascertain the current required and the jigs engage with copper work bars spaced along the conveyor.

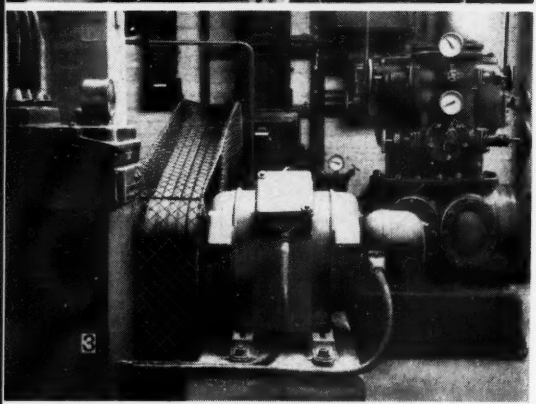
Lifting of the jigs from the truck and subsequent transfer from one process tank to the next is effected by means of two carriages on rails; the upper carriage first moves forward, drawing the lifting chains with it over idler pulleys on the lower carriage. Both carriages then move forward together, conveying the jigs to the next process tank. As the upper carriage moves back the frame is lowered into the tank where the copper work bars fit



The sections of window frames are welded together







(1) Some of the paint pumping equipment. (2) One of the motors which drive the lifting mechanism. An air duct for removing the fumes can also be seen. (3) Refrigeration plant employed in the sulphuric acid recovery plant

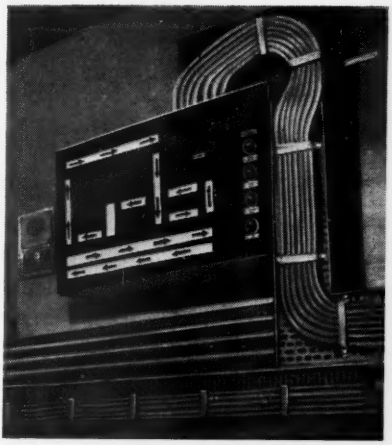
automatically into copper shoes. To cover the whole sequence of operations of the plant there are altogether three of these lifting units. Each one is operated by a single motor through a Witton Kramer drive, reduction gears and a magnetic clutch, the motor being first coupled to the upper carriage and then through the magnetic clutch to the lower so that when the clutch is energized both carriages move. The motors (G.E.C.) of two of the lifting units are of 10 h.p. and the third is of 6 h.p. A 1½ h.p. Laurence Scott motor at each end of the plant drives the conveyor chain through hydraulic couplings which provide for the slight differences in the rate of drive and give smooth starting.

Should a frame slip out of position it comes into contact with one of the stainless steel trip wires which are provided at the leaving edge of each tank and automatically stops the whole plant until the fault is remedied. Lifting of the sets is carried out simultaneously from all tanks as each sequence starts. The complete plating process takes 1 hr 20 min, including 2 min rinses between each operation. After 5 min 10 sec in the alkaline degreasing tank the frames are rinsed before pickling. This is in two stages. The first, taking 8 min 20 sec, is the cathodic pickle in which the frames are made cathodes, anodes being of antimonial lead. The sulphuric acid solution in the bath is thermostatically controlled at 140 deg F by means of a " Satchwell " thermostat.

For this cathodic pickling a current density of 100 A/sq ft is employed. As the usual surface area of steel in a window is between 30 sq ft and 40 sq ft the total current density for the bath of about 150 sq ft is equivalent to 15,000 A at 6 V. Electrical contact is made through a shoe on to copper V-bars. Fumes are drawn off at bath level by means of ducting and extract fans driven by eight Higgs 15 h.p. 725 r.p.m. motors. Air throughout the plant is extracted at 73,000 cu ft/min.

A rinse in cold water prepares the frames for the anodic pickling (5 min 10 sec), which removes the black smut left by the cathodic pickling and gives the frames a bright surface ready for plating. For this sulphuric acid of the same concentration is again used but the current density is only 80 A/sq ft, which in the case of a 7,500 gall tank works out at about 1½ A/gall. Lead coils containing cold water cool this tank and then supply the rinse tanks. After a further rinse, sodium cyanide dipping (2 min), which, in addition to removing any passivity, neutralizes any trace of acid still remaining.

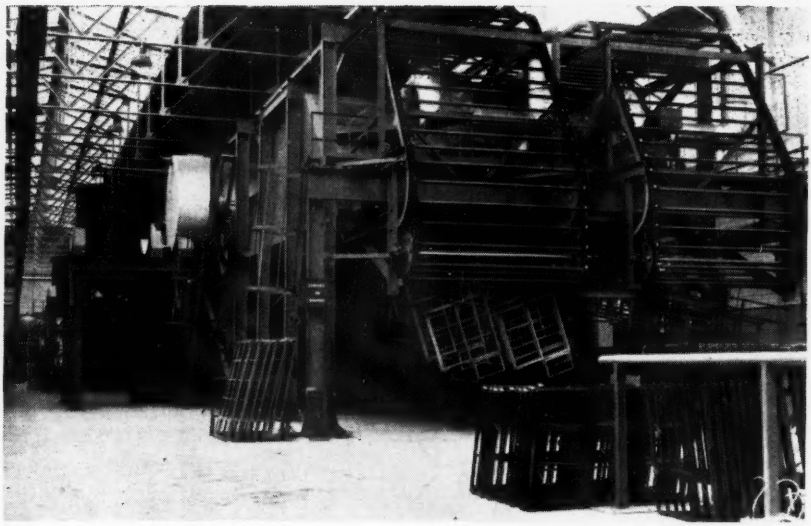
In the plating tank, which is 80ft long and 8ft wide with a solution depth of 5ft 9in, the current is applied at 7 V and a current density of 25 A/sq ft is employed, control being by means of motor operated regulators. The 420 anodes employed are of 99·99 per cent pure zinc and each weighs 56 lb. A gunmetal clamp together with the weight of the anode itself ensures a good contact with the conductor rails. Replacement of the anodes—their average life is three months—is facilitated by a special trolley equipped with an outrigger hoist. The 26,000 gall of solution contained in the bath is maintained at a temperature of 70 deg F by means of steam coils and is continuously filtered. The time taken for plating is 21 min.



An illuminated diagram indicates the stage of operations reached

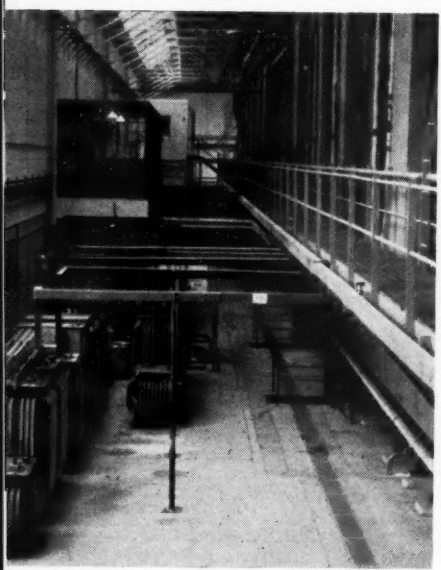
Cold and hot water rinses are followed by the phosphating process which takes 2 min, further cold and hot water rinses completing

The exit end of the plating plant showing special truck



The painting and stoving plant

A portion of the rectifier and transformer equipment with the control house in the background



the plating sequence. The frames are then unloaded on to a truck similar to that used for loading and here again a limit switch is employed to prevent the lowering of the frames before the truck is in position.

Transfer of the various solutions from the storage tanks to the baths and vice versa is effected by means of a series of La Bour acid resisting pumps driven by Crompton Parkinson 1½–7 h.p. motors fitted with Watford or Contactor Switchgear starters. Electrically operated pumps are also used for carrying spent pickling solution to a sulphuric acid recovery plant (John Thompson, Ltd.). Here in a crystallizer the ferrous sulphate is removed by rapidly cooling the solution, from 140 deg F to 10 deg F, with a refrigerated brine jacket and coils while continuously stirring. The refrigeration plant employed for this purpose is a J. & E. Hall unit driven by a Brush 22 h.p. 960 r.p.m. slip ring motor with Allen West starter.

The low voltage d.c. required for pickling and plating is provided by banks of Westinghouse "Westalite" oil immersed rectifiers and Bruce Peebles transformers connected to the 400 V three-phase supply and fitted with automatic voltage regulators. Each bank delivers 500 A at 4–7 V and four banks are provided for the cathodic pickling, three for the anodic pickling and five for

the plating. Brush h.v. switchgear is employed with Reyrolle apparatus for the l.v. side. English Electric distribution boards are installed.

Leaving the plating plant, the frames are wheeled to the painting and stoving plant (F. J. Ballard, Ltd.) where they are suspended from hooks on a chain conveyor. Moving at a speed of 8 in/min this conveyor then carries the frames successively through a drying oven, a dip tank containing chromated red oxide paint, a gas-fired stoving oven, a second dip tank containing the finishing coat, and a second stoving oven. Cooling fans are fitted between the various stages.

Should a fire break out a Pyrene CO_2 spraying installation would be brought into operation automatically by solenoid operated valves on the bottles of CO_2. At the same time pressure switches would trip the circulating and exhaust fans of the ovens and also shut off the gas supply. The gas supply is also automatically shut off in the event of a fan or power failure, and cannot be restored until the fans are restarted.

Altogether 42 motors ranging from 1 to 22 h.p. and representing a total of 174 h.p. are employed to operate the various conveyors, fans, paint circulating pumps (Stothert & Pitt), etc., employed in the painting and stoving plant. These motors, which were supplied by Crompton Parkinson, Ltd., are controlled from groups of isolator and starter panels supplied by Brook Motors, Ltd., Electrical Apparatus Co., Ltd., and Simplex Electric Co., Ltd. The starters for the conveyors are located at each end with remote control emergency stop buttons at intervals along the plant.

We are indebted to Maclean & Co. (Metal Windows), Ltd., for granting us facilities to inspect the plant.

Tests For Metals

THE formulation of tests by which the quality of metal products could be assessed without having recourse to full-scale testing was one of the earliest tasks to be undertaken by the British Standards Institution. This resulted in the adoption of a series of standard tensile test pieces. Since then a number of British Standards have been issued which deal with different types of mechanical tests and a number of other standards include requirements for specific applications of these tests.

The standards dealing solely with mechanical testing, together with extracts from other standards to illustrate particular applications of the tests, have now been collected and published as B.S. Handbook No. 13. This reference book is useful not only to industry but to universities and technical colleges where the subject of strength of materials is taught.

The development of standard methods of test and their importance in the field of mechanical testing, are reviewed in the introduction by Dr. H. J. Gough, who is a member of the Mechanical Engineering Industry Standards Committee and was for many years closely connected with the work, being for some time chairman of some of the committees concerned.

The Handbook is arranged in sections dealing with types of tests; seven sections cover tensile, hardness, impact and ductility tests, the transverse tests for cast iron and the verification of tensile and compression testing machines.

Each section quotes in full the British Standards for the type of test being dealt with and continues with suitable extracts from other standards, where such exist, which illustrate particular applications of the test. The section dealing with tests on thin metal departs from this principle by quoting the whole of a standard which deals comprehensively with the tensile, bend hardness and ductility tests for thin metal sheet and strip material.

The final section embodies a comprehensive series of conversion factors and conversion tables, which include values of stresses and moments of inertia converted from inch-pound units to metric units and *vice versa*. Copies of this publication are available from the British Standards Institution, Sales Department, 24, Victoria Street, S.W.1, price 17s 6d, post free.

London Tram Conversion

STAGE 6 of the scheme for converting South London's tram routes to bus operation will be put into effect this week-end. It is the most extensive so far and will mark the end of trams at Victoria and along Vauxhall Bridge Road as well as in Grove Park, Downham and Catford. The six routes to be withdrawn operate from West Norwood, Grove Park Station and Downham to Southwark, Blackfriars and Victoria.

Trams withdrawn will number 109 and buses introduced 105, making altogether 523 trams withdrawn and 592 buses introduced. Including the latest conversion the route mileage of abandoned tracks will be 55·2 and the remaining mileage 46·5.

Electricity in the '52s

Some Noteworthy Centenaries

By G. J. S. KING

ALREADY, when the year 1852 opened, the *entente électrique* had come into being by the establishment of telegraphic communication between Dover and Calais, and this "linking of the fringes" was followed during the year by a linking of the centres. On 1st November direct telegraphic connection between London and Paris was opened, and the first message, flashed from Cornhill to the heart of Paris, expressed the general desire and belief that man's mastery of science might help to inaugurate a millenium:—

> "The Directors of the Submarine Telegraph Company beg leave to approach his Highness the Prince President with the expression of their best thanks for the assistance which he has uniformly given towards the establishment of this instantaneous means of communication between France and Great Britain. May this wonderful invention serve, under the Empire, to promote the peace and prosperity of the world."

Telegraph Blamed for Earthquake

With France came Ireland. The first telegraphic communication between the sister isles took place on 1st June, when the cable was completed between Holyhead and Dublin. It was not long before the new contraption was being made a scapegoat. Late in the year a Limerick journal reported an earthquake shock, and assured its readers that: "Scientific men will ascribe this convulsion, wholly unknown in Ireland before, to the effect of the electric telegraph wires, whose atmospheric influence is so powerful."

There were others who were apprehensive of the dangers of the new invention. *Punch* reported an imaginary convention of "swell mobsmen" who realized they had a "new and terrible foe to contend with." They were to be "nabbed through electricity"; they feared, with reason, that the Government would "never legislate against electric wires."

There were a number of interesting advances in electrical research and activity during 1852. The great James Prescott Joule published a paper "On the Heat disengaged in Chemical Combinations," which contained a description of perhaps the first of all accurate galvanometers; and Lord Kelvin (then Professor Thomson), who was working in close conjunction with Joule in laying the foundations of thermodynamics, announced, in a paper read at Glasgow, his theory of the "dissipation of energy." (Sir) George Gabriel Stokes anticipated Kirchhoff's discovery of spectrum analysis, and read his famous paper on "The Change in the Refrangibility of Light or Fluorescence"; and John Tyndall, who was noted for his magnetic investigations (and for his subsequent investigations of the transparency and opacity of gases and vapours to radiant heat) was elected a Fellow of the Royal Society.

Roget's Diverse Achievements

There is a reminder of the many-sidedness of men of genius in the achievements of Peter Mark Roget, who was a physician and savant, an inventor, and the author of treatises on electricity and magnetism, but who became famous in a wider field that year by the publication of his renowned "Thesaurus of English Words and Phrases." Other publications of 1852 were the completion of the "Magnetical Investigations" of William Scoresby, the Arctic explorer; James Braid's work on animal magnetism and electro-biology (including observations on Colquhoun's "History of Magnetism"); Henry Dircks' "Jordantype, otherwise called Electrotype" (a vindication of the claims of C. A. Jordan to be the inventor of electro-metallurgy); and the beginning of Reichenbach's publications on the "Odic Force."

Electricity was still a youthful science, but gradually it was attracting recruits from

the older professions. We find, for example, so famous a sportsman as Robert Grimston forsaking the law in 1852 for electric telegraphy, by joining the board of the Electric Telegraph Company. The British and Irish Magnetic Telegraph Company was formed that year to take over William Thomas Henley's patent of the magnetic needle telegraph. In October (Sir) Charles Tilston Bright, another celebrity who joined the Magnetic Telegraph Company that year, took out a patent for " improvements in making telegraphic communications and in instruments and apparatus employed therein and connected therewith " (which included the acoustic telegraph).

(Sir) Francis Ronalds, who had begun his famous researches into electric telegraphy nearly forty years previously, received a Civil List pension of £75 per annum in 1852 " for his eminent discoveries in electricity and meteorology." (Sir) Edward Sabine discovered the connection between sunspots and magnetic storms; Lewis Pocock patented a scheme for electric lighting; (Sir) Goldsworthy Gurney, whose lectures on electricity many years previously had inspired Faraday, devised a lighting system for the new Houses of Parliament (which had just been opened); an electric clock was installed in the Strand; and—a first introduction of the new science to music—Dr. Henry Gauntlett patented his invention for applying the principle of electricity to the organ.

Voltaic Battery Applications

Our introductory reference to the " Prince President " of France is a reminder that this dignitary was Louis Napoleon, who had recently usurped power in that country. Before the year was out he had advanced his status from president to emperor, with the title of Napoleon III, and in that same year he directed that a substantial cash prize should be awarded every five years for the most useful application of the voltaic battery. No award was made for twelve years—and Heinrich Ruhmkorff then received the prize for his induction coil.

The centenary, on 1st January, of the death of John George Children, Secretary of the Royal Society, recalls a celebrity who had assisted his father in the construction of new and large galvanic batteries in the opening years of the nineteenth century. The experiments of father and son, with a battery of twenty-one cells, had aroused intense interest, and had procured for the younger Children the Royal Institution medal. Two years before Waterloo he demonstrated the largest galvanic battery that had yet been seen.

Another notability who died in 1852—on 2nd July—was Thomas Thomson, who was the first to make public Dalton's atomic theory, and was author of " An Outline of the Sciences of Heat and Electricity."

Atomic Research

Only brief mention can be made of a few of the outstanding celebrities born during 1852 who are of direct or indirect interest to electrical men. There should be a special word for Sir William Ramsay (2nd October), from whose many brilliant achievements we might select the discovery of neon, with its immense commercial advantages. He was also a pioneer in atomic research, and his work in radioactivity is a reminder that Antoine Henri Becquerel, who was born on 15th December in the same year, was its discoverer, and has perpetuated his name in the " Becquerel rays."

There are those of an older generation who will have personal memories of Sir William Ramsay, and also of John Henry Poynting, who was born on 9th September, 1852, so that he was less than a month Ramsay's senior. Poynting was the author of " On the Transfer of Energy in the Electromagnetic Field " (which enunciated the famous " Poynting's Theorem "), and " On the connexion between Electric Currents and the Electric and Magnetic Induction in the Surrounding Field." Both these papers were read to the Royal Society, and their immense importance as regards the subject of electrical energy was recognized by the award of the Society's medal to Poynting, " for his researches in physical science, especially in connection with the constant of gravitation and the theories of electro-dynamics and radiation."

Another name of outstanding eminence is that of Albert Abraham Michelson, the American physicist, who was born on 19th December, 1852, and was noted for his joint share in the Michelson-Morley experiment, which inspired the Einstein theory. He has given his name to the Michelson

interferometer, and was author of "Velocity of Light" and "Light Waves and Their Uses."

Henri Moissan, who was born on 28th September a century ago, will be remembered for his introduction of the electric furnace named after him, and also as the author of various books on electrical subjects. Jacobus Henricus Van't Hoff (30th August) was noted for his work in thermodynamics, and in connection with the theory of electrolytic dissociation. Harold Baily Dixon (11th August) experimented in photometry, and among other works he was the author of "On the Decomposition of Carbonic Acid by the Electric Spark."

George James Burch invented improved methods of using the capillary electrometer for recording and measuring rapid changes of electromotive force, and was the author of "Electrical Science," "The Capillary Electrometer," etc. James Edward Henry Gordon (26th June) wrote a treatise on electricity and magnetism while he was assistant secretary of the British Association. He lectured at the Royal Institution on electrostatic induction, and equipped Paddington Station with electricity.

The year 1752 was memorable for Benjamin Franklin's discovery of the identity of lightning and electricity. In the same year Pierre Lemonnier, a Frenchman, discovered that even in fine weather a "state of electricity" existed in the atmosphere. These were contributions from America and France—and in February that year Britain's (Sir) William Watson, who was then, in the words of Joseph Priestley, "the most interested and active person in the kingdom in everything relating to electricity," made public his famous experiments on the electrical discharge in vacua. Gowin Knight, whose magnetic researches had begun when he discovered the effects of a flash of lightning upon a ship's compass, was rewarded by the Admiralty, in June, for his improved mariner's compass; and John Freke published his "Treatise on the Nature and Property of Fire," which was the result of his electrical experiments in the few preceding years.

A final name in our survey is that of Leonardo da Vinci, probably the most versatile genius the world has ever seen, who was born in the year 1452. The inquiring mind of Leonardo explored magnetic attraction, and his researches included such problems as the conservation of energy, and even of waves in the air. Had the span of human life, and the exactions of conflicting interests, not deflected Leonardo from translating thought into action, many an invention and discovery that history has ascribed to a later age would have been credited to him.

STREET LIGHTING NOTES

AT a meeting of PENRITH Urban District Council it was reported that where gas mains used for street lighting were in need of replacement the surveyor had approached the North Western Electricity Board regarding the installation of electric street lighting. Owing to restrictions on capital expenditure, however, it had not been possible to make much progress. No electric lighting had so far been provided for the main trunk road, the Scaws estate and Croft Terrace.

A special sub-committee of the BRADFORD Corporation has approved a suggested programme and draft plans submitted by the city engineer for the first stage of a scheme for the proposed conversion of street lighting from gas to electricity, and the street lighting superintendent is to obtain estimates of the cost of the proposed conversion from the Yorkshire Electricity Board.

Mercury vapour lighting is to be installed on the Crown Street, Eastfield and Welland Close estates, PETERBOROUGH (estimated cost £3,435).

Work has started on the conversion from gas to electric street lighting of a two-mile stretch of the main Huddersfield–Wakefield road through the centre of HORBURY.

FINCHLEY borough engineer and surveyor has suggested to the Highways Committee that provision should be made in the 1952–53 estimates for the re-lighting of the whole of Bishop's Avenue.

ENNERDALE (Cumberland) R.D.C.'s £2,362 street lighting scheme for Egremont main street has been deferred by the Ministry of Transport.

MARYPORT (Cumberland) Highways Committee has instructed the surveyor to prepare a scheme for installing electric street lighting throughout the area.

WAKEFIELD Corporation General Purposes Committee is to obtain tenders for street lighting in Barnsley Road, Thornes Road and Batley Road.

Dimming Fluorescent Lamps

Practical Aspects of Circuits and Other Considerations

By G. ROBINSON, A.M.I.E.E.*

TWO characteristics of fluorescent tubular lamps prevent their being dimmed as easily as tungsten filament lamps. One is that reducing the input voltage to an installation soon causes arc instability and flickering while the other is that the usual method of dimming tungsten lamps, by using one large variable resistance to control a number of lamps in parallel, only produces a very limited range of dimming when applied to discharge lamps. The fundamental theory behind these characteristics of fluorescent lamps has already been dealt with in considerable detail.†

The ordinary switch-start hot-cathode circuit is useless from a dimming point of view as the switch is designed to operate over a limited range of current and voltage. Therefore, some years ago attention was concentrated on the instant start circuit. It was found that the right approach was to incorporate a variable impedance in circuit with each lamp, or each pair of lamps in series, which can be either resistive or inductive, as explained separately below.

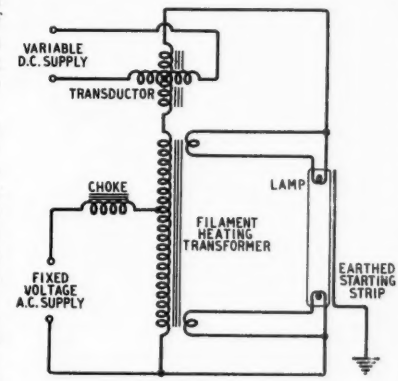


Fig. 1.—Typical transductor circuit for an extended range of dimming

Dimming of Hot-Cathode Lamps

For the first method each lamp is controlled by a separate variable resistance of several thousand ohms, according to the degree of dimming required, the resistances being ganged together mechanically as necessary. The system has disadvantages in the case of large installations, particularly in the considerable wiring involved, the wattage loss in the dimmers and the bulkiness of the dimmer board. It is more suited to small installations where extreme flexibility is required, such as in stage lighting with colour effects when several circuits have to be controlled by hand at varying speeds.

Maximum loss in the resistance dimmer, occurring at 70 per cent of full light output, is 10·5 W/1,000 lumens of full light output when using 5ft daylight lamps. Two 2ft 40 W lamps in series controlled by one resistance have been used for such high flexibility dimming, but the pair has the disadvantage of being approximately 25 per cent less efficient than one 5ft 80 W lamp.

The transductor system was introduced for inductive dimming principally in order to facilitate the dimming of large installations by manipulating either stud type potentiometers or variable transformers, only one or a small number of which are necessary. This system requires fewer wires between control gear and dimmer bank than resistance dimming, thus reducing installation costs. Smoother dimming is obtained when using the transductor method than with a resistance having the same number of studs, due to the reactance of the transductors.

In the typical circuit for this system, incorporating a filament heating transformer, choke and transductor (Fig. 1) the transductor consists of two a.c. windings on the outer limbs of a shell-type laminated core with a large d.c. coil wound on the

* Illuminating Engineering Dept., General Electric Co., Ltd. † I.E.E. *Proceedings*, Part 2, Vol. 98, No. 64, August, 1951.

centre limb (Fig. 2). In its essentials the effect of the transductor is as follows: the two a.c. windings (A and B) are connected in series in the opposite sense, resulting in a full choking effect when d.c. is not applied. There is no a.c. flux in the centre core with both coils energized as shown, which means that only normal insulation is required for the d.c. control coil when using a three-limbed core.

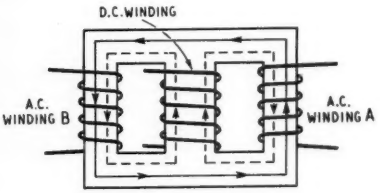


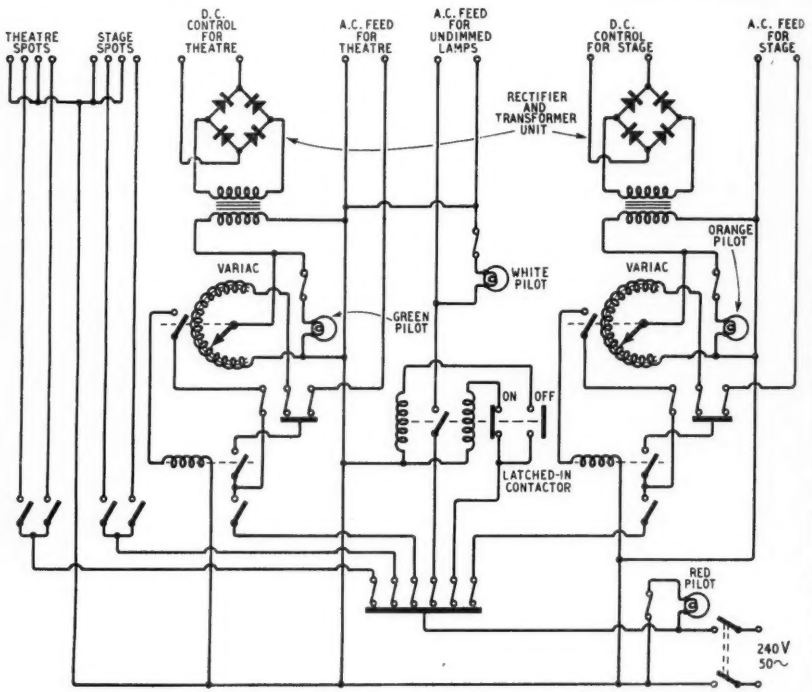
Fig. 2.—Flux paths (full line instantaneous a.c. and dotted line d.c.) in simplified form of three-limbed transductor

When the d.c. coil is energized the a.c. winding (B) tends to produce extra flux in the same direction, but is unable to do this as the d.c. has already saturated the core. Therefore, in this particular a.c. half cycle no flux change occurs and neither is there a choking effect in winding (B). Meanwhile the other a.c. winding (A) has a demagnetizing effect on the d.c. flux in its magnetic circuit, and the flux change resulting produces a back e.m.f. with its associated choking effect. For the next half cycle the effects in the a.c. windings are reversed.

A dimming range of 55 : 1 has been found to be satisfactory in certain applications and involves an impedance variation of approximately 100 to 8,000 ohms, but larger ratio transductors have been produced for a greater degree of dimming.

Fig. 3 is the circuit for a dimmer board which was supplied by the General Electric Co., Ltd., for the demonstration theatre of the South Western Electricity Board at

Fig. 3.—Dimmer panel circuit for demonstration theatre in Bristol



Bristol. It is believed to be one of the largest installations of hot-cathode lamps dimmed by transductors in the country.

In this theatre an installation of twenty-eight 5ft 80 W lamps producing 100,000 lumens is controlled by turning the hand wheel of one "Variac" which, in conjunction with the rectifier transformer unit, produces d.c. at from 0 to 120 V for all the paralleled d.c. coils on the transductors. It should be noted that 28 separate resistors would be required to produce the same effect, had transductors not been used.

All the control gear for the lamps, including the capacitors for improving the power factor, is arranged near the distribution boards for convenient maintenance. Maximum loss in the dimming system occurs at full light output and can be made as little as 7 W/1,000 lumens of the full light output when using daylight lamps by omitting the choke, although this reduces the dimming ratio very slightly.

Dimming of Cold-Cathode Lamps

The cold-cathode fluorescent lamp lends itself readily to efficient and economic dimming, since several lamps can be operated in series from a step-up transformer producing up to 5,000 V above earth on open circuit, falling to approximately 2,800 V on load. To those who are not too familiar with cold-cathode lighting, it should be pointed out that the high operating voltage may seem a disadvantage at first, but many years of experience have proved beyond doubt that there is no more risk of fire or shock than with mains voltage equipment, providing the appropriate I.E.E. Regulations are observed.

It is possible to obtain a fair measure of dimming, to perhaps one-eighth of full light output, by paralleling transformers serving multi-tube circuits and using one series variable resistance in a similar manner to filament lamp practice. It is necessary to use approximately 25 per cent more transformers than is usual, but power factor correction may be carried out across each transformer primary. All mercury-filled tubes, such as white, green and blue, respond quite well to this arrangement, but neon-filled tubes, such as gold and red, present more difficulty.

A very successful arrangement was developed for the Royal Festival Hall and Telecinema at the Festival of Britain South Bank Exhibition (Fig. 4) and has since been

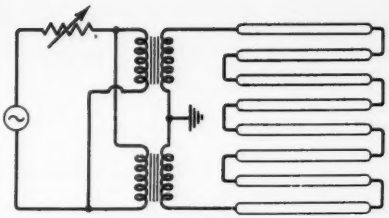
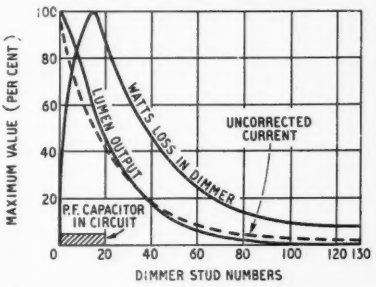


Fig. 4.—Eight cold-cathode lamps arranged for resistor control

Fig. 5.—Graphical representation of change of light output of the eight Fig. 4 lamps



used elsewhere. By coupling in tandem two high reactance transformers with low magnetizing currents, it is possible to operate a lighting length of up to 68ft of cold cathode white tubing in series, producing a total of 17,000 lumens. The resistance required for this circuit is of the order of 1,000 ohms and a dimming ratio of 600 : 1 is obtained.

Similar results can be obtained with certain coloured tubes and it should be mentioned that neon filled tubes can produce red light at more than three times the efficiency in lumens/W of hot-cathode red lamps, the latter using fluorescent powders and filters. This gain in efficiency of the red tube is shown in true perspective when it is realized that 12 reds would be necessary to produce approximately the same flux of coloured light as is given by three blue, one green or two yellow hot-cathode lamps. In establishing these comparative figures it will be appreciated that the degree of saturation of each colour has not been allowed for.

Fig. 5 is a graph of the change of light output and wattage dissipation against dimmer movement over 130 studs of dimmer

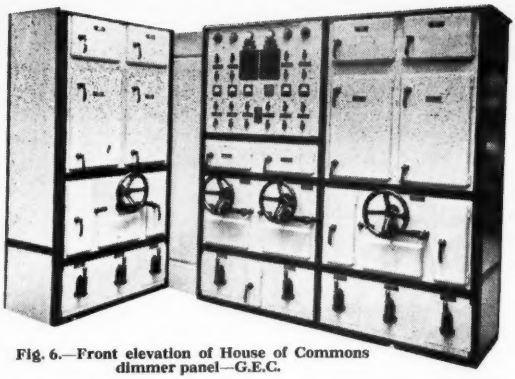


Fig. 6.—Front elevation of House of Commons dimmer panel—G.E.C.

traverse for the Fig. 4 circuit. It may be added that, as in standard filament lamp practice, the curve of light output against time has a general logarithmic character, modified as experience dictates, and the curve takes account of eye response as dealt with in Fechner's Law. In addition Fig. 5 shows the curve for uncorrected current, together with the position most suitable for switching out the power factor correction capacitors.

Maximum loss of the dimming system occurs at 60 per cent full light output and is equivalent to 16·7 W/1,000 lumens of full light output. It is instructive to compare that figure with the equivalent filament lamp dimmer loss, which would be approximately 20 W and 48 W/1,000 lumens of full light output for high wattage and low wattage lamps respectively at 8 per cent of full light output. Apart from large dimmer losses, the efficiency of a filament lamp at 8 per cent of full light output may fall as low as 2–3 lumens/W whereas the high lumens/W efficiency of fluorescent lamps remains fairly constant at 30 to 40, irrespective of lamp current.

Transductor dimming of cold-cathode tubes becomes economically justifiable when such tubing is used on a large scale, as in the laylight at the House of Commons, where over 2,000 ft of tubing is dimmed. In a similar manner to that outlined for hot-cathode tubes, individual transductors are wired into each transformer primary and one master input goes into all d.c. windings on the transductors.

In the case of the dimmer board used for the House of Commons Chamber lighting (Fig. 6) the centre panel is devoted to the control of the cold-cathode lighting in the laylight, while the two end sections control the hot-cathode lamps situated on the window sills and under the gallery. Maximum loss in the dimming system occurs at full light output and is equivalent to 10 W/1,000 lumens of full light output when using intermediate white lamps.

It is evident that the best results with any lighting installation are obtained only when skilful use is made of the most suitable illuminant for each particular scheme. It is worthy of note that an analysis of cost figures for the lighting of various auditoriums shows that the lower initial cost of a hot-cathode installation, as compared with that of an equivalent cold-cathode one, is largely offset when dimmng equipment is being considered. This remark is true whether using transductor or resistor dimming.

Careful consideration must, therefore, be given to other factors besides initial cost. They include lamp replacement cost, lamp life, lamp efficiency, flexibility of lamp shape and reliability of the system. This article has been confined mainly to the characteristics of fluorescent dimming equipment, but it will be evident that other factors are inseparable from the problem of providing the best possible lighting installation when incorporating facilities for dimming.

Conveyor Belting

THE second revision of B.S. 490, which is concerned with rubber conveyor and elevator belting and was revised as a war emergency edition in 1943, reverts, to a great extent, to the original Standard of 1933, but now has five weights of fabric as well as three grades of rubber covering. It also gives details regarding the construction of the belting as well as stipulating limits for defects, tolerance, strength of fabric and adhesion. Methods of test are given in the appendices, where information is also contained about the selection of belting and service conditions. In view of the present shortage of cotton, an amendment slip is published simultaneously, temporarily relaxing the strength of the fabric by 5 per cent.

Copies may be obtained from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 3s post free.

VIEWS on the NEWS

By REFLECTOR

MR. Justice Vaisey's recent dismissal of an application by the National Trust for an injunction against the Midlands Electricity Board in connection with the proposed overhead line on the Malvern Hills was accompanied by some remarks by His Lordship on the subject of amenity preservation. He considered that the restrictive covenant upon which the Trust based its case was couched in such " wide, vague and indeterminate " terms that it was impossible of comprehension or construction and was wholly unenforceable. He sympathized with those who wished to preserve the countryside but it was necessary to maintain a sense of proportion in the matter. One point to which he drew attention was the fact that the nearest of the unwanted poles was 1,100 yards distant from Midsummer Hill (the subject of the covenant); they were no doubt visible from the hill on a clear day but their effect upon the landscape was infinitesimal. I am sure that the Board, and indeed all the Electricity Boards, are anxious to preserve amenities but they have to pay regard to the cost, too, when meeting public demands for power.

* * *

While most people complain that their electricity is costing too much there are, it seems, some more-than-contented consumers who insist on paying their bills twice. According to the *Manchester Guardian*, the South Western Electricity Board is to issue " warning " letters to a " surprisingly large " number of people in Bristol asking them not to do it. What other reason than sheer delight with the service could give rise to such a peculiar habit?

* * *

Cutting the first sod for a new power station is a very sober ceremony in this country. Local dignitaries and representatives of the B.E.A. deliver solemn speeches at a luncheon and then some more on the site when a symbolical spadeful of earth is disturbed. How differently things are ordered in the United States. The *Electrical World* has an illustrated account of the " groundbreaking " for the new Delta plant of the Mississippi Power & Light Co. First there arrived by air a horde of " investment bankers and financiers " and the function was set in motion by a parade of " majorettes " from the Cleveland (Miss.) High School, a bevy of attractive young women in abbreviated pseudo-military costume. Then four sturdy men including the lieutenant-governor of the State and the president of Middle South Utilities, Inc., seized spades and turned up a sizeable patch of earth. Later, at luncheon employees of the company waited on the 400 guests. Imagine the reaction of the daily Press if the B.E.A. did anything like this!

* * *

An extension of the electric fence idea is contemplated in Westminster as a means of preventing starlings from settling on buildings in the care of the City Council. The Public Health Committee, in reporting experiments in the use of low-voltage wires, says that considerable success has been achieved. I think, however, that some of the ratepayers may think that this success has been gained at their expense. The Committee realizes that the effect will be to divert the birds to other buildings, but it considers that the property owners concerned could follow the Council's example.

* * *

The Beckbury (Salop) Parish Council, to whose unenlightened attitude I referred last week, is not to be allowed to rest in self-imposed obscurity. A petition has been presented by the villagers demanding the calling of a public meeting at which the decision not to have public lighting will be reconsidered. It is thus possible that the village will be allowed to have the four-candle lantern which a public-spirited resident has offered. Then it may proceed by easy stages to eventual electric light.

New Year Honours

A LONG list of New Year Honours was published on Tuesday last and from it we have selected the following names of electrical and allied interest:—

The new Knights include Mr. G. P. Barnett, H.M. Chief Inspector of Factories; Mr. J. L. Blake, Comptroller-General of the Patent Office; and Mr. H. E. Miller, chairman, International Rubber Development Board. Major-Gen. C. Bullard, C.B.E., B.Eng., M.I.Mech.E., M.I.E.E. (R.E.M.E.) is appointed a companion of the Order of the Bath.

Among the new Commanders of the Order of the British Empire (C.B.E.) are Mr. G. L. Bailey, Non-Ferrous Metals Research Associa-

Mr. T. H. Windibank

Mr. A. G. Robertson

tion; Mr. A. F. Bennett, M.I.E.E., director and joint general manager, Automatic Telephone & Electric Co., Ltd.; Mr. A. G. Robertson, M.M., director, Contracts Dept., G.P.O.; and Mr. T. H. Windibank, M.I.E.E., director, Crompton Parkinson, Ltd.

Officers of the Order (O.B.E.) include Mr. F. C. Carter, staff engineer, P.O. Engineering Dept.; Mr. T. G. Christie, M.I.Mech.E., M.I.E.E., chief engineer, Northern Ireland Electricity Board; Mr. I. S. Dalgleish, A.M.I.E.E., J.P.; Mr. G. H. Fletcher, M.I.Mech.E., M.I.E.E., Metropolitan-Vickers Electrical Co., Ltd.; Mr. Robert James, M.I.Mech.E., member, South Wales Electricity Board; Mr. F. H. Lansbury, secretary, Cable & Wireless, Ltd.; Mr. J. D. McGee, M.Sc., Ph.D., A.M.I.E.E., Electric & Musical Industries, Ltd.; Mr. R. T. Rolfe, F.R.I.C., chief metallurgist, W. H. Allen, Sons & Co., Ltd.; Mr. W. A. Royle, M.I.Mech.E., M.I.E.E., chief commercial officer, North Eastern Electricity Board; and Mr. F. R. Moultrie, Electrical Dept., Bahamas.

Members of the Order (M.B.E.) include the following:—Mr. E. Bradshaw, M.Sc., Ph.D., M.I.E.E., senior lecturer, Manchester College of Technology; Mr. T. T. Callison, A.M.I.E.E., Bonar, Long & Co., Ltd.; Mr. P. G. Campling, M.I.Mech.E., M.I.E.E., manager, Chilterns Sub-Area, Eastern Electricity Board; Mr. T. A. Fraser, staff officer (manual workers), London Electricity Board; Mr. H. C. A. Linck, A.M.I.E.E. (G.P.O.); Mr. A. N. Mansfield, M.I.E.E., engineer, No. 4 Sub-Area, Merseyside and North Wales Electricity Board; Mr. T. R. Matthews, Geo. Kent, Ltd.; Mr. C. A. Packer, G. & J. Weir, Ltd.; Mr. A. J. Parsons, A.M.I.E.E., Mawdsleys, Ltd.; Mr. V. R. F. Peers, Simplex Electric Co., Ltd.; Mr. H. E. Sharp, M.I.Mech.E., J. I. Thornycroft & Co., Ltd.; Mr. J. Sim, Electrical Trades Union; and Mr. S. B. Taylor, manager, Government Contracts, English Electric Co., Ltd.

Mr. A. F. Bennett

Among those to whom British Empire Medals (B.E.M.) have been awarded are:—Mr. B. J. Brown, London Division, B.E.A.; Mr. J. C. Charlton, North Eastern Electricity Board; Mr. T. J. Davies, Hoover (Washing Machines), Ltd.; Mr. A. Dilley, East Midlands Electricity Board; Mr. F. W. Frost, South Eastern Division, B.E.A.; Mr. G. Godding, General Electric Co., Ltd.; Mr. W. Heath,

Mr. W. A. Royle

Mr. G. H. Fletcher

Yorkshire Division, B.E.A.; Mr. G. P. Hibbs, British Thomson-Houston Co., Ltd.; Mr. W. E. Mitchell, Affric Hydro-Electric Scheme; Mr. G. L. Nicholas, South Wales Electricity Board; Mr. F. Pearce, Troughton & Young, Ltd.; Mr. W. Souter, Henry Wiggin & Co., Ltd.; Mr. E. Stevenson, Midlands Division, B.E.A.; Mr. E. C. Tunnicliffe, Standard Telephones & Cables, Ltd.; Mr. H. G. Turnell, Tullis, Russell & Co.; and Mr. W. J. Wilson, North Western Division, B.E.A.

PERSONAL and SOCIAL

News of Men and Women of the Industry

WITH effect from 1st January, **Mr. John W. Bailey**, M.I.E.E., has been appointed a junior director of Ewbank & Partners, Ltd. Mr. Bailey was a student at Faraday House from 1922 to 1926, after which he joined Edmundsons Electricity Corporation, Ltd., and was appointed by them in 1939 as chief distribution engineer to the Cornwall Electric Power Co., holding this position until 1947, when he joined Ewbank & Partners, Ltd., as chief electrical assistant.

Mr. R. Stuart Pilcher, C.B.E., F.R.S.E., M.Inst.T., who has been licensing authority for the West Midland Traffic Area, Ministry of Transport, since 1946, is retiring on 29th January. He is being succeeded by **Mr. W. P. James**, O.B.E., a principal in the Ministry of Transport.

Mr. H. E. Duggans has been appointed to the position of divisional manager in the Export Department of Hoover, Ltd., and will be relinquishing his duties as manager, "Glassmaster" sales. **Mr. W. L. Moore** succeeds Mr. Duggans as manager, "Glassmaster" sales and relinquishes his duties as branch manager of the Midland branch. His headquarters will be at Wadsworth Road, Perivale, Middlesex. **Mr. R. V. Cable** has been appointed an assistant divisional manager in the Export Department.

Sir Alexander Roger, K.C.I.E., chairman of British Insulated Callender's Cables, Ltd., and the Automatic Telephone & Electric Co., Ltd., left this country on 20th December on a visit to the Union of South Africa, the Rhodesias and Portuguese East Africa. He will be away for approximately three months. During this tour he will visit the branches and agents of the respective companies. **Mr. H. F. Akehurst**, export manager of B.I.C.C., and **Mr. R. H. G. Lee**, export director of Automatic Telephone & Electric, are accompanying Sir Alexander Roger.

Mr. H. F. Farmer, F.Inst.W.M., superintendent, control gear factory, B.T.H., Rugby, on 1st January relinquished this position, which he has held for twenty-one years. He is joining the Works Manager's Department, Rugby, for special duties. Mr. Farmer will be succeeded by **Mr. P. J. Dawton**, M.Inst.W.M., who has been assistant superintendent under Mr. Farmer since 1940. Mr. Dawton served an engineering apprenticeship at B.T.H. Rugby Works, from 1917 to 1922. After subsequent drawing office experience at Rugby, he joined the staff of the Planning Department in 1929, and in 1937 became chief assistant to the superintendent, control gear factory, and assistant superintendent three years later. Mr. Dawton was a member of the Electric Motor Control Gear and Small Switchgear Productivity Team which visited the United States in 1949 under the auspices of the Anglo-American Council on Productivity.

Mr. P. J. Dawton

In our issue of 21st December we reported three new appointments in the Electrical Engineering New Works and Development Organization, Railway Executive H.Q., London. We now reproduce the portraits of **Mr. W. J. Webb**, B.Sc. (Eng.), A.M.I.E.E., senior technical assistant (power supply), London Bridge, who has been appointed to the position of assistant for substations, **Dr. H. I. Andrews**, M.Sc., M.I.Mech.E., A.M.I.E.E., senior assistant (engineering), Railway Executive Research Department, Derby, who becomes

Mr. W. J. Webb

Dr. H. I. Andrews

Mr. F. Claxton

general assistant, and **Mr. E. Claxton,** B.Sc., A.M.I.C.E., A.I.Mech.E., A.M.I.E.E., assistant electrification engineer, Electrical Engineering New Works and Development Section, Kings Cross, who becomes electrification engineer.

Mr. C. W. Marshall, B.Sc. (Eng.), M.I.E.E., deputy chief engineer (research) of the British Electricity Authority, has been appointed controller of the Authority's South West Scotland Generation Division in succession to the late Mr. E. J. Edgar. Mr. Marshall was born at Carluke, Lanarkshire, in 1890. He is a graduate of Glasgow University, where he was a James Watt Scholar, and began his career in the electricity supply industry with the Glasgow Corporation, with whom he was employed for some fourteen years, latterly as chief technical assistant. Shortly after the formation of the Central Electricity Board in 1927, he became the Board's technical and research engineer, a position which he held until his appointment with the B.E.A.

Mr. C. W. Marshall

Mr. Marshall has made a special study of modern methods of generation, transmission and distribution of electricity in this country and abroad, and has published books dealing with generating stations, protective gear and battery vehicles. He has been closely identified with research activities in the industry as a member of the E.R.A. Council, the Electricity Supply Research Council set up by the B.E.A. and a number of international organizations.

Mr. Marshall was chairman of the Meter and Instrument Section of the Institution of Electrical Engineers in 1940-41 and initiated the development of that Section into the Measurements Section. He is an honorary member of the Association des Anciens Elèves de l'Institut Montefiore of Liège, Belgium, and of the Société Française des Electriciens of which he holds the Ampère Medal. He is also a member of the Board of Studies in Electrical Engineering of the University of London.

Mr. W. A. Gallon, B.Sc., M.I.E.E., M.Inst.F., chief engineer of the South Eastern Electricity Board, has been appointed controller of the Merseyside and North Wales Generation Division of the British Electricity Authority. He succeeds **Mr. A. R. Cooper,** M.I.E.E., M.Inst.F., who was recently appointed controller of the North Western Division.

Mr. Gallon received his technical education at Durham University. After service with the Newcastle-upon-Tyne Electric Supply Co., Ltd., and Imperial Chemical Industries, Ltd., Billingham, he joined the Plymouth Corporation in 1935 as chief assistant engineer. Three years later he was appointed assistant borough electrical engineer of Southampton and from 1941 until he joined the South Eastern Electricity Board on its establishment in 1948, he was borough electrical engineer of Woolwich.

Mr. D. G. Arden, M.I.E.E., F.Inst.Pet., is retiring from the post of chief electrical engineer at the National Oil Refineries, Ltd. (Anglo-Iranian Oil Co.), which he has held for the past 26 years. During this period he has been chairman of the I.E.E. West Wales Sub-Centre (1944-45) and chairman of the Western Centre (1950-51). Mr. Arden's successor is **Mr. G. D. Curtis,** B.Sc., A.M.I.E.E., who joined the refinery from the Stourport generating station of the British Electricity Authority.

Mr. H. E. Fleetham, B.Sc., has resigned his appointment as a director of Taylor Electrical Instruments, Ltd., and early this year is taking up an overseas appointment with a group sales organization formed by a number of firms in the S.I.M.A. His private address, for the time being, remains as 49, Harlington Road, Hillingdon, Middx. (telephone : Uxbridge 5737).

Matthew Hall & Co., Ltd., held their annual party recently when a number of guests were received by the chairman and joint managing director, Mr. Bertram Baden, M.C., and other directors. There was a display of models and photographs depicting some of the company's home and overseas activities in a number of fields including air

At the Matthew Hall & Co. party: Messrs. P. Doulton (Matthew Hall), E. Baden (Matthew Hall) and W. Courtauld (Courtaulds, Ltd.)

conditioning (embracing the Royal Festival Hall), district heating, panel heating, prefabrication and welding, hydro-electric schemes, electrical installations, oil refineries, chemical engineering, etc.

On 31st December **Mr. T. Smalley,** Associate I.E.E., works manager of Dorman & Smith, Ltd., retired from active participation in the organization after more than fourteen years' service, during which time he was responsible for the development of all new designs. Mr. Smalley still retains an interest in the activities of the Dorman Smith group of companies in a consultative capacity and he will remain a director of one of the companies.

Informal group at a luncheon given by the East Midlands Electricity Board to members of the East Midlands Electricity Consultative Council and the Press at Nottingham on 19th December. Left to right: Mr. J. W. Rayment (chairman, Lincs. Committee), Mr. J. Mould (deputy chairman, E.M.E.B.), Mr. C. R. King (chairman, E.M.E.B.) and Mr. L. L. Perkins (chairman of the Consultative Council)

At the annual Christmas dinner on 21st December, Mr. Thomas Atherton, Companion I.E.E., managing director, presented a silver tea service to Mr. Smalley on behalf of the board, and presentations were also made on behalf of the staff and works.

Mr. L. J. Earp, engineering manager at the Birmingham works of Berry's Electric, Ltd., has been appointed an executive director of the company.

Mr. L. J. Earp

A Christmas party organized by the **Sloan Electrical Co. Social Club** was held at the Royal Hotel, Russell Square, London, on 22nd December. Over 100 adults and 48 children enjoyed the well-balanced programme of games and dancing (to the Casino Quartette) and the highlight of the evening was the appearance of Father Christmas with a toy and torch for each child. The M.C. was Mr. Ronald Munn, and the role of Father Christmas was admirably carried out by Mr. George Bunney.

Mr. Allen Hirst, who recently retired from the joint managing directorship of Brookhirst Switchgear, Ltd., has been presented with an antique silver scroll ink stand, with wafer box, a taper candlestick and snuffer, a cut-glass inkwell and cut-glass sand container.

Mr. Crawford T. Robertson, for forty-four years buyer for G. & J. Weir, Ltd., Cathcart, retired on 28th December after fifty-one years' service with the company. Mr. J. K. Weir, managing director, recently presented Mr. Robertson with a wallet of notes, and a handbag for Mrs. Robertson.

Mr. J. J. Eades has been appointed a director of the Automatic Telephone & Electric Co., Ltd.

In the report of the dinner given to Mr. H. Denton in last week's issue, we incorrectly stated that **Mr. H. Rayner** was associated with the Igranic Electric Co., Ltd. Mr. Rayner is a director of Contactor Switchgear, Ltd.

To share the increased duties devolving upon the present managing director, Mr. Montague Burningham, the board of Keith Blackman, Ltd., has appointed **Mr. D. S. Woodley,** A.M.I.Mech.E., M.I.V.H.E., to act as joint managing director with Mr. Burningham. Mr. Woodley joined the company in 1916, and in 1925 was placed in charge of the Leeds branch office. In 1931 he was appointed chief engineer, and in 1938 was elected to the board, becoming deputy chairman in 1950. Consequent upon this new appointment **Mr. S. E. Nelson,** B.A. (Cantab), will succeed Mr. Woodley as chief engineer of the company.

The 50th anniversary of **H. E. Kettle, Ltd.,** was celebrated on 21st December with a Christmas party at the Georgian Ballroom, Maidstone.

Some 1,000 staff members of **British Insulated Callender's Cables, Ltd.,** and the B.I.C. Construction Co., were present at the Seymour Hall, London, on 13th December, for the Group's Southern Staff social function. Those present included the chairman, Sir Alexander Roger, K.C.I.E., the deputy chairman and chief executive, Mr. W. H. McFadzean, C.A., and the deputy chairman, Mr. P. V. Hunter, C.B.E., together with many of the directors. Dance music was provided by two bands and there was a cabaret. Mr. W. G. Hawley, A.M.I.E.E.

(high voltage research manager), proposed a vote of thanks to the directors.

The silver medal offered by the Stoker and Furnace Makers' Association to candidates who are employed in a boiler house and obtain the highest number of marks in the City and Guilds final examination in boiler house practice, has this year been awarded to **Mr. Allan Martin,** of Burnley, a student of the Burnley Municipal College. Mr. Martin is employed by the British Electricity Authority as an assistant stoker at Padiham power station. At a gathering in the College, which included Dr. Wales, the principal, Mr. A. B. Wilkinson, head of the Department, and Mr. G. Sharpe, lecturer, the medal was presented to Mr. Martin.

On 20th December, four employees of the **Carter Electrical Co., Ltd.,** with over twenty years' service were presented with gold watches, and sixteen with over ten years' service received stainless steel watches. The presentations were made by the Misses E. M. and V. E. Carter, directors of the company, and sisters of the late managing director, Mr. H. J. Carter.

Falk Stadelmann & Co., Ltd., held their children's Christmas party in the staff canteen, Farringdon Road, on 29th December. Nearly a hundred children welcomed Father Christmas, who presented each with a toy and traditional Christmas gifts of fruit and sweets. Entertainment was provided by Punch and Judy, a conjuror and ventriloquist, followed by party games. The party arrangements were in the hands of Miss Furness and Mr. Powell, acting on behalf of the Veritas Efesca Social Club Committee.

OBITUARY

Mr. R. C. Wade, B.Sc., A.M.I.E.E., engineer in charge for the British Insulated Callender's Construction Co., Ltd., of the contract for the installation of the overhead equipment on the Manchester-Sheffield railway electrification scheme, died suddenly on 20th December. Mr. Wade was born in 1905 and was educated at Rossall School and Birmingham University. He joined the former B.I. Cable Co., in 1928 as an engineer in the Contract Department and from 1937 to 1939 was assistant engineer in Warsaw for the electrification of the Polish State Railways. On his return from Poland he worked as assistant to Mr. H. B. Davies on the Liverpool Street to Shenfield electrification contract. During the war he took charge of the company's airfield contracts with headquarters at St. Neots. When the Manchester-Sheffield electrification was recommenced after the war he was appointed resident engineer. Mr. Wade was employed on his normal work until a few hours of his death.

Mr. A. Pollitt.—The death occurred on 23rd December, at the age of sixty, of Mr. Arthur Pollitt, M.I.Mech.E., M.I.Mar.E., A.M.I.E.E., deputy controller of the London Division of the British Electricity Authority. Mr. Pollitt was educated at the Salford Grammar School and the Royal Technical Institute, Salford, and served an apprenticeship with Browett, Lindley & Co., Ltd. He subsequently held appointments with Hick, Hargreaves & Co., Ltd., the British Westinghouse Electric & Manufacturing Co., Ltd., and the Brush Electrical Engineering Co., Ltd., and in 1919 joined the Manchester Corporation Electricity Department where he was engaged on the development of the Barton power station. When Sir Leonard Pearce left Manchester to join the London Power Co., in 1926, Mr. Pollitt accompanied him as assistant chief constructional engineer and, in 1932, succeeded to the post of chief constructional engineer, in which position he was largely responsible for the design, development and commissioning of the Deptford West and Battersea power stations. On nationalization he became chief generation engineer (construction), B.E.A., London Division and was appointed deputy divisional controller in October, 1950. Mr. Pollitt was a freeman of the City of London as a liveryman of the Worshipful Company of Horners.

The late Mr. A. Pollitt

Mr. Edward Gould Tillyer, A.M.I.E.E., died at St. Albans on 29th December in his eighty-sixth year.

WILLS

Mr. J. J. Wood, personnel and advertising manager of Bulpitt & Sons, Ltd., Birmingham, who died on 5th March last, left £11,853 gross (£11,787 net).

Mr. T. W. Graves, A.M.I.E.E., of 23, Lyndhurst Avenue, N.W.7, formerly a senior assistant in the Chief Engineer's Department of the L.C.C., who died on 11th August last, left £3,176 gross (£3,083 net).

Mr. R.G. H.C. Brookes, B.A., A.M.I.E.E., lecturer in electrical engineering at Liverpool University, who died on 4th January last, left £20,810 gross (£20,752 net).

Mr. E. L. Hayward, joint secretary of Siemens Electric Lamps & Supplies, Ltd., and secretary of Battery Carbons, Ltd., who died on 31st October last, left £2,217 gross (£2,160 net).

Engineering in Europe

Survey of Current Literature

THE connection of capacitor batteries into a power system causes disturbances of which the designer must take account. They are of two different types: one, the transient type, occurs on circuit-making and becomes more dangerous with increasing power of the transformers. Anti-harmonic inductance coils may considerably reduce the amplitude of these transients. When the capacitance of the capacitors is large, their connection into the circuit is preferably operated in two stages, with a shock-reducing resistance inserted and cut out again. The second type of disturbance is due to the system harmonics and represents a permanent risk, especially when the transformer is idling. The capacitors must be so dimensioned that their temperature rise is kept within certain limits and that the response of certain electromagnetic apparatus, particularly overload relays, to high-frequency components superimposed on the main current is excluded. It is recommended that the capacitors shall be inserted only when the transformer is under load (required by the Electricité de France regulations). Also, the total capacitance of the batteries used should not be excessive and should be subdivided into appropriate sections so that it may be inserted by elements rather than as a complete unit. In most cases 50 kVAr will be the most suitable unit rating.—" Coupling of Capacitors for Improving the Power Factor," M. Bizot, *Revue Générale de l'Electricité*, Vol. 60, No. 7, pp. 274–278, July, 1951, in French.

Surges on Transformers

This part of the paper deals particularly with the transmitted or induced voltage surges in the secondary windings which may reach dangerous values and cause breakdowns even in the case of step-down transformers. The problem could be solved by calculations based on the symbolic method, were it not that the numerical evaluation becomes in many cases impossibly laborious. It is important not to overlook the phenomenon of electrostatic induction which may have some effect where the voltage levels of primary and secondary windings are of the same order. These effects are obviously quite independent of the transformation ratio and their duration is much shorter than that of the inductively transmitted phenomena.

An attempt is made to discuss test results (oscillograms) in a general way and qualitatively by choosing the most suitable equivalent circuits and an approximative formulism. The general conclusions which can be drawn are: the longitudinal stresses are more uniformly distributed than in the case of the direct impulse, and therefore the precautions to be taken are fewer and of a less exacting kind. Layered helical windings which have an approximately uniform stress distribution for direct impulses, are also the most favourable ones where transmitted waves are concerned. Voltages against frame may become higher in transmitted than in direct impulses, but in this respect small transformers are less in danger because their decrement of damping is much higher. An earthing of the secondary terminals of large transformers through surge impedance of several hundred ohms will often help. The steepness of the wave front is much less for transmitted waves than for direct ones; this may increase the dangers for the secondary winding arising from a steep-fronted wave relatively to the primary winding where the dangerous peak lasts not nearly so long.—" New Contribution to the Surge Problem of Industrial Transformers," III, S. Kohn, *Revue Jeumont*, Vol. 44, pp. 10–21, January–March, 1951, in French.

Wear Resistance of Enamelled Wires

Although the main acceptance conditions for enamelled wires were standardized (in Germany) some ten years ago, it was not then possible to foresee the wide range of applications to which the remarkable development and improvement of this type of conductor would lead, nor some of the specific stresses to which the wires would be subjected.

The coat of enamel is endangered by tensile stresses, but more so by bending during the winding process. Additional causes of wear are occasional undetected deficiencies on the winding machine (especially on the wire guides) and sharp or burred edges on coil formers or stampings, etc. The resistance to these scratching and cutting effects is not easily characterized by a figure, but it is possible to carry out a simple test in which a tester of standardized shape and dimensions is pressed with a given force against the coat of enamel and moved relatively to the latter either in the direction of the wire or at right angles to it (more precisely, in one sense only, or to and fro, so that the rubbing effect becomes severest). This cannot but result in gradual wearing-off of the coat, and the number of cycles required for a complete removal furnishes a characteristic of the wear strength of the enamel.

Although the method in itself is conclusive, the problem consists in finding a test edge of "ideal" sharpness. This was, after long experiments, found in a simple glass strip cut from a pane (the edge of the strip opposite to the side scratched with the glass-cutter). This primitive device, inserted into a simple, motor-driven testing machine which is controlled by a relay cutting the drive out when the insulating effect disappears, furnishes reliable and reproducible data on the "scraping strength" of the enamel coat.—"Determination of the Wear Resistance of Enamelled Wires," F. Polenz, *Elektrotechnische Zeitschrift*, Vol. 72, pp. 551-552, 15th September, 1951, in German.

[Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at the current rates.—*Editors, Electrical Review.*]

Newcastle Transport Jubilee

THE transport system of Newcastle-on-Tyne City Council, the sixth largest in the country, has celebrated its 50th birthday. On 16th December, 1901, the city's first electric trams came into operation, followed 11 years later by motor-buses. In 1935 trolley-buses made their appearance and the trams were gradually scrapped. The undertaking now comprises trolley-buses and motor-buses. During its 50 years' existence, the transport system has contributed half a million pounds from its profits to the city's finances.

Earthing Electric Tools

THE difficulty of maintaining efficient earthing connections on portable electric tools was stressed by Mr. J. L. Wood, regional safety officer, British Electricity Authority, Portobello, when he spoke to the Incorporated Plant Engineers, Glasgow Branch, recently. This difficulty had forced designers and users on to some form of safeguard such as low-voltage usage coupled with effective preventive maintenance.

Emphasis should be placed on prevention rather than correction and Mr. Wood demonstrated examples of defective operation arising from preventive failures. Experience had indicated that the dangers involved argued the need for an increase in the safety factor and a great deal of thought had been given to devise schemes to disconnect automatically. He outlined two main systems of safeguards, the circulating current earth continuity system and the Butcher-Black & Decker system.

There was a tendency to operate electric tools at lower voltages, some as low as 50 V, on the principle of "the lower, the safer, the better." But there were disadvantages as considerations of performance were involved. Toolmakers seemed to favour the 210 V system, while the B.E.A. had adopted the 110 V system especially where risks were abnormal. This system had the support of H.M. Inspectorate of Factories.

N. Rhodesian Imports

IMPORTS of electrical goods into Northern Rhodesia in 1950 showed an increase of about 80 per cent in value on 1949. The officially recorded items are given in the accompanying table, with notes of increases or decreases (the latter being insignificant) compared with the preceding year. It is noteworthy that the Union of South Africa has taken the second place as supplier.

Class of Goods	1950 £(000)	Inc. or dec on 1949 £(000)
Electrical machinery and material n.e.e.	1,462	+ 660
From United Kingdom	1,137	+ 539
" *Union of S. Africa*	248	+ 118
" *United States*	62	— 1
Batteries	82	+ 17
From United Kingdom	19	+ 12
" *South Africa*	31	+ 4
Electric lamp bulbs	35	+ 11
From United Kingdom	19	+ 6
" *South Africa*	8	+ 5
" *United States*	8	+ 1
Telegraph and telephone instruments and apparatus (nearly all from U.K.)	131	+ 101
Radio apparatus, appliances and parts	121	+ 10
From United Kingdom	88	+ 17
" *South Africa*	16	— 19

Atomic Power

The Economic Aspect

An assessment of the possibilities of atomic power in "civilian" applications is made by Professor R. S. Sayers (University of London) in the December *Three Banks Review*. Professor Sayers writes as an economist, not a physicist, although he broadly indicates the nature of the technical problems involved. He thinks that sufficient "fissionable" material will be available for the production of atomic energy on a huge scale, although the squandering of the richest resources for the production of atomic weapons may hinder progress in the early years.

Professor Sayers, dealing with "individual" applications of atomic power, thinks that it may be possible to drive ships in this way but the atomic propulsion of such comparatively small vehicles as railway engines or cars is ruled out by the heavy and expensive protective screening.

Generating Stations

For the same reason small private generators are ruled out. He therefore conceives the atomic power centre as rather large electricity generating stations. In these the coal furnace would be replaced by atomic piles involving trivial labour costs. The capital cost, however, would be very high indeed. "Expert guesses suggest that, if capital charges are reckoned at 10 per cent per annum, the big electricity stations could be more cheaply run on atomic energy than by coal-firing or oil-firing; but the difference would not be spectacular and would certainly not be great enough to justify scrapping the coal-boilers before they are worn out, even if the present shortage of generating capacity had been overcome."

As the fuelling and operating costs of atomic plant are so trivial the decision rests on the balance between the interest charge on the additional capital outlay against the fuel and labour costs of present-day furnaces. In this matter low interest rates, low chemical engineering costs and high coal prices favour new methods and they are the factors which will decide when atomic plant has become worth installing.

Professor Sayers thinks that in the construction of such plant this country is likely to have advantages because of its experience in the field of atomic energy and its possession of the most ingenious chemical engineers. It is thought that the cost of development should not be judged by the expenditure upon atomic bombs which is not limited by commercial considerations.

Another factor is the rate at which the construction costs are turned into a running capital charge. Here depreciation depends upon the degree of success in the solution of construction problems, particularly in developing new materials which will stand up to the radio-active materials emerging in the process. There would be huge scope for the development of atomic power if interest rates fell to very low levels.

Where fuel is at present expensive atomic power would lower costs sufficiently to enable native ores, etc., to be processed on the spot instead of being shipped to other countries for treatment.

The whole of the railway system might be revolutionized. Electrification would become more attractive. The use of atomically-generated electricity instead of coal in the metal industries and atomic heat for district heating would reduce the need for coal haulage.

Continuous Operation

From the very nature of the process atomic power stations will have to operate continuously; there can be no variation in output to meet peak loads. Therefore Professor Sayers thinks that the already difficult peak-load problem should be treated, not as ephemeral, but as a condition likely to be accentuated, and steps should be taken to deal with it.

The article concludes with an expression of the opinion that no immediate industrial revolution based on atomic energy is in sight, though the effects may be appreciable by the twenty-first century. Professor Sayers thinks it sensible for this country to press on with the development of atomic plants which, although very costly, would largely free the country from dependence on deep-mined coal or imported power.

Cooker Production

Expanding Demand and Material Shortage

THE chairman of the Associated Manufacturers of Domestic Electric Cookers, Mr. Percy Tonks, in presenting his report at the close of the financial year, said that the indications were that the total production of cookers for 1951 would exceed that for 1950, although the increase would not be so great as in 1950.

With the housing plans recently announced by the new Government, it could reasonably have been anticipated that demands for electric cookers would continue to increase. Against this must be set the deteriorating raw material position and the adverse effect of electricity cuts.

The closer relationship with the Electricity Boards to which reference had been made in the previous year's report continued to develop. The cooker manufacturers had received from the Government Departments responsible the greatest help in the problems relating to the allocation of steel and other scarce materials. An allocation scheme for steel for cookers for export had been introduced and there had been a steep rise in exports.

The need to economize in essential materials, particularly non-ferrous metals, had raised considerable technical and design problems in the employment of alternative materials. Furthermore, to offset rising production costs, simplification and economy in design and finish had had to be considered.

During the year the effects of wage awards and other increases in costs of labour and raw materials on cooker production costs had been studied. As a result, members had, broadly speaking, been able to coordinate their price policy and in consequence to increase list prices with due regard to the public interest and the need to foster hire and hire-purchase schemes. Mr. Tonks claimed that it could justly be said that the increases on cookers and components, including boiling plates, had been extremely moderate, bearing in mind the heavy increases in production costs which manufacturers had had to absorb.

It was unfortunate, at a time when the public was becoming more and more aware of the advantages of electric cooking that the manufacturers should be handicapped by the difficult national electricity supply position and the shortages of raw materials, particularly steel, of which the electric cooker had such a high content. Taking the long view, these difficulties must be transitory and the chairman looked forward with the greatest confidence to the day when it would be unusual not to cook by electricity.

Mr. Tonks concluded by expressing his regret at his inability to offer himself for re-election, because of the extra duties resulting from his appointment as joint managing director of the Revo Electric Co., Ltd. He also expressed his sorrow at the retirement of Mr. E. G. Sellers as a result of the recent decision of Elexcel, Ltd., to discontinue production of electric cookers.

Mr. J. A. Fraser (English Electric Co., Ltd.) was unanimously elected chairman for the ensuing year, with Mr. Ivor Williams (General Electric Co., Ltd.), as vice-chairman. As his first duty, Mr. Fraser made an " unofficial " presentation to Mr. Tonks of a handsome inscribed silver cigarette case, as a token of members' appreciation of his work from 1948 to 1951.

Voltage Stabilizer

IN the January, 1952, issue of *Electronic Engineering* Mr. J. V. P. Long (Department of Scientific and Industrial Research) describes a mains voltage stabilizer which has been constructed to provide an a.c. output of 230 V $\pm$ 0·5 V from an input of 230 V $\pm$ 30 V. The instrument has a response time of between 1 and 2 sec; consequently it does not smooth short duration fluctuations, but is effective for longer term drifts.

The apparatus consists essentially of an electronic circuit fed from the output of a " Variac " transformer, the circuit being arranged to operate a reversible motor which is geared to the " Variac." In this way mains fluctuations disturb the circuit from its balance position and cause the " Variac " to be rotated in the appropriate direction until balance is restored.

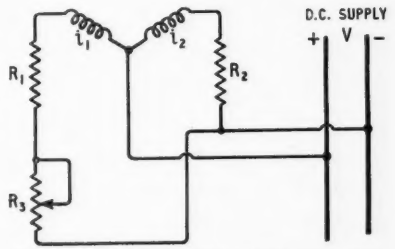
Ratiometer Position Indicators

Equipment Unaffected by Wide Voltage Variations

ELECTRICAL position indicators are already available for use on power supply circuits in which the voltage is constant within small limits and the current consumption is of little importance. On systems in which the voltage varies over a wider range, it is necessary to install voltage stabilizing equipment to operate these instruments, and for such applications there are advantages in the use of the " Metrovick " ratiometer. This device is unaffected by wide changes in supply voltage and takes only a small operating current.

The ratiometer position indicator operates on the same principle as the " Metrovick " temperature indicator in which a wire-wound thermometer changes its resistance with change of temperature, but the resistance thermometer is replaced by a rheostat. It can be used for any form of position indication, provided that the rheostat can be coupled to the moving part so as to enable a change of resistance to be related to the distance or other quantity the change in which is to be indicated. Equipments have been made for indicating the position of water turbine blades, dam and sluice gates, water levels, and so on.

The movement of the indicator is, in general, the same as that of the differential speed indicator (previously described by N. Rider in *The M-V Gazette*, 24, 34, October, 1951). The magnetic compensator, which counteracts the effects of voltage variation, is particularly valuable when the equipment is operated from batteries, as it ensures that the accuracy is not affected by the state of the battery. In fact, the accuracy is not affected by a voltage change of 50 per cent up or down and no voltage stabilizing equipment is necessary.

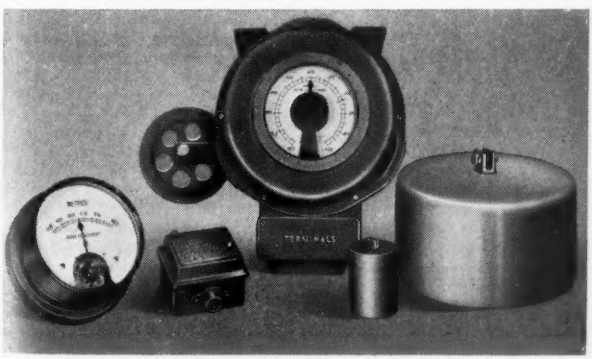


Basic circuit of the "Metrovick" ratiometer position indicator

The two circuits of the position indicator are (*a*) a control coil circuit having a fixed resistance and (*b*) a deflecting coil circuit in which a fixed resistance is connected in series with a variable rheostat; operation of the rheostat changes the current in the deflecting coil circuit, thus altering the ratio of the currents in the two coils. It is always preferable to use a large movement ratio, and for position indication the values of the various resistance elements in the two circuits can be arranged to suit the application.

From the schematic diagram it will be seen that current I_1 in the deflecting coil varies between V/R_1 and $V/(R_1+R_3)$. Therefore, for a movement

For measuring water level the apparatus comprises an indicator, temperature compensator, rheostat, counterweight and float



ratio 1·5 : 1, $R_1 = 2R_3$. The minimum value of I_1 must be considered in relation to the minimum current at which the indicator will operate satisfactorily; this current must be not less than that produced by the minimum voltage at which the indicator is required to operate. The minimum value of I_1 is determined by the design characteristics of the movement, and the current I_2 and resistance R_2 required in the control coil circuit can be found from the mean of the instrument ratio with relation to I_1 and R_1.

The operating rheostat can take any form that suits the mechanism used for transmitting the motion to be measured. Various arrangements have been used, such as a circular rheostat with forked lever and carrier pin for circular motion, gear wheel and sliding rack for linear motion, and chain drive and float for changes in liquid level.

The mechanism operating the rheostat can be arranged either to give a continuous resistance change with change in position or for step-by-step operation to indicate definite increments of change.

The total resistance of the rheostat is governed by the supply voltage, the indicator movement ratio and, to some extent, the resistance of the leads between indicator and rheostat.

As the indicator requires only a few mA for satisfactory operation, it can be connected to the rheostat and the voltage supply by high resistance leads. Indication can thus be given at a considerable distance from the operating point, which is impracticable with some types of position indicator. Where all three leads are equal in length and resistance, the system is self-compensating over a wide range of temperature, since any change in lead resistance will affect each coil circuit similarly, having, therefore, a negligible effect on the ratio of the two coil currents. This does not apply if the indicator is operated by a low voltage supply (such as a 50 V station battery) and is connected to the rheostat by 20 miles or more of overhead telephone wire, giving a line resistance equivalent to several hundred ohms. Under different weather conditions, the value of this resistance changes appreciably, and some form of temperature compensation is necessary. A simple and effective method is to fit a copper-wound element of equivalent resistance in a weatherproof case and mount it on one of the poles near the receiving end so that as far as possible it is subjected to the same weather conditions and variations of temperature as the overhead line. The resistance changes of the leads in the two circuits of the indicator will then be about the same, thus minimizing any error from this source.

The indicators can be provided in 4in and 6in round patterns and 6in edgewise patterns (projecting or flush mounting). The scale can be marked in any units desired, provided the relation between the resistance values and the angular position of the operating rheostat is given. The indicator and rheostat should be calibrated together so that any inequalities in the winding of the rheostat or of the motion used can be taken into account.

Farmers and Rural Plan

A DISAPPOINTING response has been made by farmers in Dumfries and Galloway to the five-year plan for electrification of the area prepared by the S.W. Scotland Electricity Board. This was stated at a meeting of the Stewartry Branch of the National Farmers' Union of Scotland in a letter from headquarters. A canvass of 1,232 farms showed that as many as 365 of those called upon were not sufficiently interested in the scheme to provide the Board with the information necessary to prepare individual quotations, and out of 867 farmers to whom written quotations were sent only 267 had accepted the offer to provide facilities. It was pointed out that it would be very difficult for the Union to continue to urge the need for priority to agriculture if farmers appeared to be unconcerned whether they secured the facilities offered. In a subsequent discussion several members remarked that the letter did not give a proper picture of the situation. All large farms had taken advantage of the scheme, but hill farms and small holdings could not afford to pay £100 for installation and an annual guarantee of £15. A number of the farmers had put in plant of their own. Another factor was that only farms on the planned circuits were approached.

Australian Loan Oversubscribed.—The Melbourne Correspondent of the *Financial Times* reports that the State Electricity Commission of Victoria's £A3 million loan at 4¼ per cent for ten years has been oversubscribed by £A1·75 million. A previous loan of £A6 million at 3¼ per cent realized only £A2·65 million.

MANUFACTURING PROGRESS—1951

A. Reyrolle & Co., Ltd.

A RECORD output of very-high-voltage equipment is reported by A. Reyrolle & Co., Ltd., who state that an extension of "belt-line" assembly methods for some of the smaller ranges of switchgear enabled the great demand for these standard products to be met. Further, in addition to completing important extensions in the high-voltage laboratory of both the impulse test equipment and the 50 c/s test transformers, good progress was made on buildings for extending the short-circuit testing station on an entirely new site.

Orders were received during the year for 275 kV, 7,500 MVA air-blast circuit breakers, for which the designs have been completed. An installation of outdoor air-blast switchgear rated at 132 kV and 2,500 MVA at Poole generating station was completed and good progress was also made with similar installations at a power station in Lincolnshire and at a divisional transforming station in South East England. Erection of the first 132 kV, 3,500 MVA indoor air-blast circuit breakers was begun for a power station in the London area.

The year brought an increased demand for open-type small oil-volume circuit breakers for voltages from 33 kV to 220 kV. Besides many outdoor installations supplied for service in Britain, contracts received included 132 kV equipments for Spain, South Africa, and South America, while a contract was also received for a 220 kV installation for Australia. Extensions were ordered for a 132 kV open-type indoor installation now nearing completion in South West Scotland, and a contract for 33 kV equipment for a somewhat similar indoor layout at the Victoria power station, Belfast, was started.

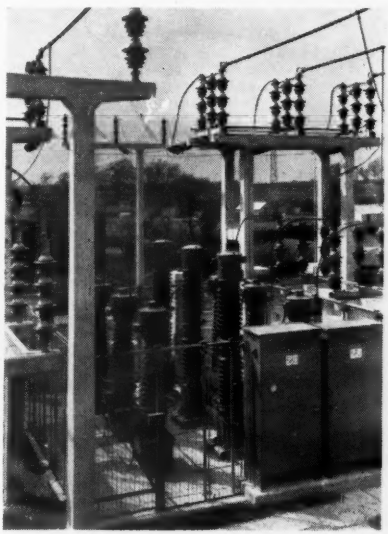
The demand for economical 500 MVA and 750 MVA 33 kV outdoor circuit breakers continues to increase, and in addition to numerous installations at home equipment has been supplied to many overseas customers, particularly in Australia, India, Canada, Spain, Hong Kong and Venezuela.

Orders for standard ranges of horizontal-draw-out and vertically isolated metalclad oil-break switchgear for voltages up to 33 kV for power station, substation, and industrial use kept the appropriate section of the factory fully employed. The demand was mainly associated with new cement works and extensions, chemical plants, steelworks and oil refineries. Equipment for the complete reorganization of the distribution system of a large aeroplane works was also ordered.

Considerable service experience was obtained with 3·3 kV and 415 V air-break switchgear, and additional orders were received for equipment of this type.

Among the orders in hand for flameproof switchgear was a contract for a complete installation at an oil refinery in Kent. New items introduced for mines included a type GA7 bell signalling transformer and an improved system of multi-motor conveyor control having such features as time-delay starting, change-over to individual control,

During 1951 there was increasing demand for small-oil-volume circuit breakers; part of 110 kV installation in Northern Ireland



and separate protection for each motor unit.

The demand for protective equipment continued to expand, and it was found necessary to increase still further the facilities for manufacture of relays and associated components.

Telephase carrier-current protection has been installed and commissioned for several important 132 kV transmission lines in England, and further operating experience of the equipment has been obtained in service with the North of Scotland Hydro-Electric Board. The problem associated with the protection of lines having high load current and low fault current was the subject of further investigation, and has been solved by new starting equipment.

Other development work resulted in the introduction of a new system of pilot feeder protection known as Solkor C, which utilizes a transductor and a telephone type relay similar to those already well tried in the mono-bias busbar-zone system, and gives higher operating speeds than earlier Solkor systems. A new duo-bias system of transformer protection was introduced; it also utilizes a transductor and a telephone type relay.

Orders for variable speed a.c. commutator motors continue to be received, particularly from overseas, and new features were incorporated in d.c. arc welding equipment. Orders were also received for special sine wave alternator testing sets for the B.E.A. and for educational establishments.

B.E.A. Plant Contracts

Month's Total Over £37 Million

DURING the past month, the British Electricity Authority has placed contracts for equipment for power stations, transforming stations, and transmission lines amounting in the aggregate to £37,297,120. The principal contracts include the following:—

Brunswick Wharf power station: 132 kV 2,500 MVA switchgear.—British Thomson-Houston Co. Hackney station: Two 300,000 lb/hr boilers.—Simon Carves. Cowes station: Two 12.5 MW turbo-alternators, condensing and feed heating plant and associated equipment.—Brush Elec. Eng. Co. Portishead "B" station, nr. Bristol: Six 300,000 lb/hr boilers.—Mitchell Engineering; one 60 MW turbo-generator.—Metropolitan-Vickers. Goldington station, Bedford: Two 300,000 lb/hr boilers.—Clarke, Chapman & Co. Tilbury station: River works.—Holloway Bros. (London). Castle Donington station, nr. Derby: Three 100 MW turbo-generators.—Metropolitan-Vickers.

Drakelow station, Burton-on-Trent: Two 60 MW turbo-alternators, condensing and feed heating plants.—English Electric; two 515,000 lb/hr boilers.—International Combustion; high pressure steam and feed piping.—Aiton & Co. Northampton station: Two 150,000 lb/hr boilers.—Simon Carves. Meaford "B" station, Stone, Staffs: Three 515,000 lb/hr boilers.—Babcock & Wilcox; condensing and feed heating plant.—B.T.H.; condensing and feed heating plant.—Hick Hargreaves & Co. Stourport "B" station: One 515,000 lb/hr boiler.—International Combustion; auxiliary power control and alarm cables.—Johnson & Phillips. Uskmouth station, Newport: Twelve 360,000 lb/hr boilers.—Babcock & Wilcox; auxiliary switchgear, transformers and accessories.—G.E.C. Connah's Quay station, nr. Flint: Two cooling towers and circulating water conduits.—Yorkshire Hennebique Contracting Co. Ince station, nr. Ellesmere Port: Condensing and feed heating plant.—Hick Hargreaves.

Doncaster station: Two 30 MW turbo-generators and condensing and feed heating plants.—Brush Elec. Eng. Co. Blackburn station: One 40 MW turbo-alternator, condensing, feed heating and evaporating plant.—English Electric. Keadby station, Scunthorpe: One 550,000 lb/hr boiler.—Stirling Boiler Co. Wakefield station, Yorks: Three 60 MW turbo-alternators.—English Electric; condensing plant and auxiliaries.—Worthington-Simpson. North Tees station, Middlesbrough: One 360,000 lb/hr boiler.—Babcock & Wilcox.

Carrington station, nr. Manchester: One 60 MW turbo-alternator, condensing, feed heating and central evaporating plant.—Metropolitan-Vickers. 3,300 V and 415 V switchgear: English Electric. Chadderton station, Oldham: Two 360,000 lb/hr boilers.—Simon Carves. Fleetwood station: Two 300,000 lb/hr boilers.—Simon Carves. Hartshead station, Stalybridge: One 150,000 lb/hr boiler.—Babcock & Wilcox. Westwood station, Wigan: Power control and indication cables.—W. T. Henley's Teleg. Works Co. Portobello station, Edinburgh: One 60 MW turbo-alternator.—Richardsons, Westgarth & Co.; one 540,000 lb/hr boiler.—International Combustion; main steam and feed pipework and valves.—Aiton & Co.; civil engineering work in foundations.—W. J. & R. Watson, Ltd. Stella South station, nr. Newcastle-on-Tyne: One 550,000 lb/hr boiler.—Clarke Chapman & Co. Roosecote station: Four 300,000 lb/hr boilers.—Yarrow & Co. West Melton substation, Yorks: 132 kV 3,500 MVA switchgear.—B.T.H.

Demand for Refrigerators

St. Helens Housing Committee has issued a questionnaire to the occupiers of 3,800 pre-war houses to find out what demand there was for electric refrigerators at a rental of 2s 1d per week. Replies received have totalled 624, including 388 against and 219 for.

Commerce and Industry

Census of Production

Aluminium Price Increase

THE Census of Production to be taken in 1953 in respect of the year 1952 is to be simplified. Forms will contain fewer questions than in any previous census and "sampling" will be introduced for the first time. These changes will substantially reduce the burden on industry and will permit the greatest possible economy in the Census of Production Office at the Board of Trade. The census will cover all producing industries as before and returns will be required from all firms over a certain size in each trade. A "sample" will be taken of smaller firms, however, which means that the majority will not be required to make a return. The information obtained from the sample will permit early estimates to be made of certain important aggregates such as total sales, materials used, stocks, and capital expenditure for each trade. As a further economy, the sample inquiry into capital expenditure carried out by certain departments in 1950 and 1951 will not be made as the information will be quickly available from the sample census. Further details of the statutory census form will be sent to trade associations early this year. Any firm requiring further particulars should write to the Census of Production Office, Neville House, Page Street, London, S.W.1.

New Plymouth Service Centre

The South Western Electricity Board's Plymouth Service Centre has been moved from cramped quarters in Saltash Street to part of the second floor of E. Dingle & Co.'s large new store in Plymouth's shopping centre. The original Service Centre was destroyed during the war and temporary premises with a floor space of about 500 sq ft, including a cookery demonstration theatre, were opened at Saltash Street in 1948. These small premises served 75,000 people in the Plymouth district and considerable difficulty was experienced in dealing with consumers calling to pay their accounts and transact other business. The new Service Centre has a floor space of about 1,200 sq ft. Six different methods of showroom illumination have been installed and are demonstrated. The Centre is conveniently situated at the top of an escalator on the second floor and the entrance is flanked by two display stands, the left-hand stand incorporating four recessed spotlights which can be focused on any display features on the stand. There are also illuminated sections for the display of cookers, washing machines and refrigerators and a cash desk for the payment of accounts.

The demonstration theatre in Saltash Street will be retained, as the new Service Centre does not include provision for demonstrations.

Part of the new Plymouth Service Centre of the South Western Electricity Board

Electric Heating Pads

A further Standard (B.S.1789: 1951) in the series devoted to domestic electrical appliances has recently been published by the British Standards Institution. It deals with electric heating pads and associated control devices, designed for supply voltages exceeding 30 V a.c. or 50 V d.c. but not exceeding 250 V a.c. or d.c. Provision is made for two types of pad: Type A, normal use (moisture resistant) and Type B, waterproof, with a maximum size in each case, one side only, of 250 sq in. Details are given

of design, construction, joints and connections, temperature control, element enclosure, covers, flexible cord switch, marking loading and rating. Full tests are included together with details of the instructions which should accompany each pad.

Safety precautions have been carefully considered in the preparation of this Standard and work is now in progress on a Standard for electric blankets. Copies may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1 (price 2s, post free).

Aluminium Price Increase

The Ministry of Materials has announced that from 1st January the price of virgin aluminium in ingot form has been increased from £124 to £148 per long ton delivered into consumers' works. For metal in notch bar form there will be an addition of £2 10s a ton as at present. The new price will apply to metal of a purity of 99 per cent to 99·5 per cent inclusive. The premiums to be paid for higher purities will be reduced to the following:—Purity, minimum 99·6 per cent, £2 per ton; 99·7 per cent, £4 per ton; 99·8 per cent, £8 per ton.

Atomic Power Plant

For the first time atomic energy has been used in the generation of electricity, successful experiments having been made on 21st December at the American national reactor testing station near Arco, Idaho.

Heat was drawn from the breeder reactor by circulating through it a molten metal, which was, in turn, used to generate steam to drive a turbine coupled to a 100 kW generator. The purpose of this first of a series of experiments is to obtain data concerning the handling of liquid metals at high temperatures under radioactive conditions and extracting heat from the reactor in a useful manner.

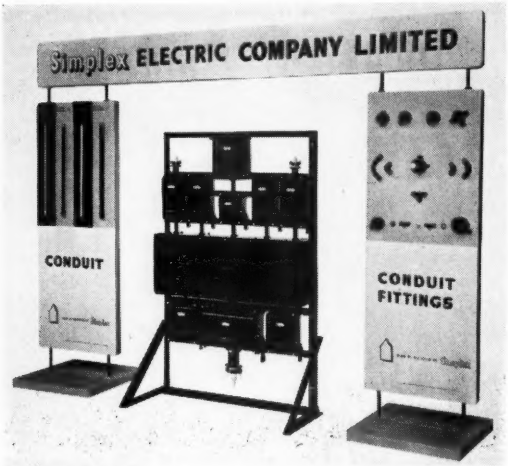
The main task of the testing station is to explore the possibility of obtaining more fissionable material from the reactor than is put into it; that is, to prove or disprove the concept that atomic fuel may be bred in the reactor. It is not disclosed what liquid metal is used to extract heat from the pile in the experimental generating plant.

Coal Prices Increased

As from 31st December the pithead prices of all coals were raised by an average of 5s per ton. In announcing the increase the National Coal Board said that for all inland coal, apart from house coal, the Board had taken the opportunity of introducing at the same time another instalment of its rational price structure whereby pithead prices would be fixed according to the quality of the coal as determined by scientific analysis and commercial knowledge. Within the average increase of 5s a ton the prices of individual industrial and carbonization coals would therefore be varied by differing amounts according to quality. The Board's Divisions would notify individual buyers as quickly as possible of the price variations in the coals supplied to them.

Switchgear Display Unit

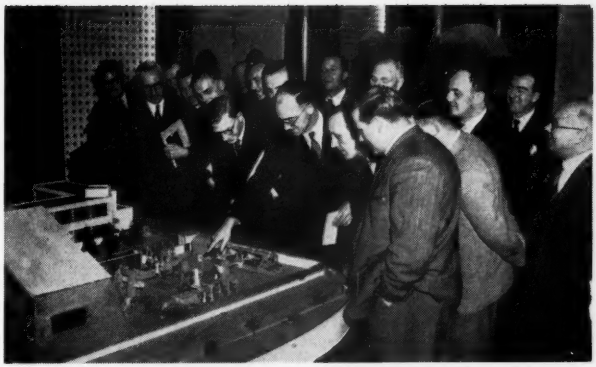
The accompanying picture shows a new Simplex display which is made up of an angle-iron switchgear panel, a conduit fittings display and a conduit display. This display unit has been forwarded to the agents of the Simplex Electric Co., Ltd., in Ceylon. Walker, Sons & Co., Ltd., of Colombo, for use in the "Colombo Plan" Exhibition which will be held during February. The exhibition will last a month and is designed to advance the plans drawn up at the Conference of Foreign Ministers of the Commonwealth, which met in Colombo in January, 1950. The aim of the "Colombo Plan" Exhibition is to demonstrate the needs of the countries in East and South-East Asia, and the contribution that will be made—in the way of capital goods and assistance—by the countries of the Commonwealth and the United States.



New "Simplex" display unit

A.S.E.E. Visit

At the display centre of British Insulated Callender's Cables, Ltd., on 14th December, the company's London branch sales staff entertained members of the North West London Branch of the Association of Supervising Electrical Engineers. The visitors were welcomed by Mr. G. J. Poole, M.I.E.E., the home sales manager. After refreshments, the party was conducted round the display centre by Mr. N. H. Miller, A.M.I.E.E., the London branch manager, and members of his staff. The visitors inspected demonstrations of wire rope parting, welding, and power factor correction and saw various displays of cables, detachable fused tee boxes, overhead traction equipment and other exhibits illustrating the B.I.C.C. field of activities. Films were shown illustrating the manufacture and laying of cables, railway electrification, the erection of the Sutton Coldfield television mast and the construction of the Leatherhead 275 kV experimental line.



Members of the A.S.E.E. at the B.I.C.C. Display Centre

Electric Clocks at Colston Hall

Referring to our article of 16th November relating to the Colston Hall, Bristol, the Synchronome Co., Ltd., informs us that it supplied all the electric clocks throughout the building, and not the G.E.C. as stated. We regret the error.

Trade Announcements

The **Sloan Electrical Co., Ltd.,** has appointed Mr. W. E. Hughes to represent it in the eastern part of Lancashire, including a portion of Manchester, and Mr. A. Williams to represent it in Cheshire, except for that portion bounded by Altrincham, Sale and Lymm. The western side of Lancashire will continue to be covered by Mr. H. P. Jones.

The address of **Checklox** is now 25, Melcombe Street, Baker Street, London, N.W.1 (telephone : Welbeck 6382).

Uni-Tubes, Ltd., has removed to Alpha Works, Alpha Street, Slough, Bucks (telephone : Slough 24606).

From 21st January, the London branch office of **Santon, Ltd.,** will be at East Acton Arcade, Old Oak Common Lane, East Acton, W.3 (telephone : Shepherds Bush 3311). The stores are operating from this address as from 1st January.

Mr. C. M. Black has been appointed as technical representative of the Illuminating Engineering Department of **Thorn Electrical Industries, Ltd.,** in Scotland, and commences his duties immediately. He will operate from the company's Glasgow offices at Craighton Industrial Estate, Barfillan Drive, Paisley Road West, Glasgow, S.W.2 (telephone : Half Way 4967).

The **Truvox Engineering Co., Ltd.,** of Wembley, Middlesex, has transferred its business to an associate, Truvox, Ltd. All orders and contracts will be executed by Truvox, Ltd. This arrangement is purely domestic and will in no way affect the company's manufacturing and trading policy. The management of Truvox, Ltd., is still under the same control.

It is jointly announced by **Elliott Brothers (London), Ltd.,** and **James Gordon & Co., Ltd.,** that the Elliott-Hagan control system for steam plants is now available from both companies. The sales and technical departments of both companies offer their assistance to users, consultants and contractors. Specialist staffs and manufacturing resources enable them to design, supply and commission complete installations for all types of steam plant.

News from Australia

The Federal Government is to spend £1,127,169 on auxiliary generating plants to speed production in Commonwealth defence factories. These auxiliary plants will be installed in both New South Wales and Victoria, and it is hoped that they will be in use by the end of 1952.

The Tasmanian Parliament has passed a Bill empowering the Hydro-Electric Commission to borrow an additional £15,800,900 for the development of the two new power stations at Lake Echo and Wayatinah, to provide an extra

180,000 h.p. for the State. The Opposition supported the Bill but attacked the Government for its failure to make known, two years ago, the serious position of the electricity supply.

It is officially announced that the Snowy River hydro-electric scheme will be enlarged to produce about three million kW, 333,000 kW more than originally planned.

The City Electric Light Co., Ltd., Brisbane, will shortly make a par issue of 1,328,945 ordinary shares of £1 each in the ratio of one to six held, bringing subscribed capital to £9,302,618.

Women Engineering Workers

The claim by women employed in the engineering industry for an increase of £1 a week has been referred to the Industrial Dispute Tribunal. Negotiations between the leaders of the five unions and the Engineering and Allied Employers' National Federation failed to reach a settlement, an offer by employers of 10s not being acceptable to the unions.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £148 0s 0d
COPPER, H.C. Electro	ton £227 0s 0d
Fire Refined 99·7 per cent ..	ton £226 0s 0d
Fire Refined 99·2 per cent ..	ton £225 10s 0d
COPPER Tubes	lb 2s 2d
Sheet	ton £280 0s 0d
H.C. wire and strip	ton £254 0s 0d
LEAD, English	ton £176 10s 0d
Foreign	ton £175 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £915 0s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £194 0s 0d
BRASS Tubes	lb 2s 1d
Sheet	lb 2s 4½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE	
Wire	lb 3s 7½d
RUBBER, No. 1 R.S.S. spot ..	lb 41½d–41½d

Tinplate Workers' Scholarships

The Worshipful Company of Tinplate Workers, alias Wire Workers, are again granting ten travelling scholarships, each to the value of £50, for 1952, on the same conditions as before.

Metal Allocations

Allocations of various non-ferrous metals for the first quarter of 1952 are announced by the International Materials Conference. The allocations are again in the form of "entitlement for consumption" and the participating Governments undertake to see that their quotas are not exceeded. A total of 744,680 tons of copper is allocated, including 366,000 tons for the United States, 100,000 tons for the United Kingdom and 51,000 tons for the Federal Republic of Germany. Zinc allocations total 487,650 tons (United States 229,000 tons, United Kingdom 64,000 tons and Germany 41,000 tons).

The Copper-Lead-Zinc Committee does not recommend any lead allocations, but is keeping the supply and demand position under review.

Catalogues and Lists

Electrical Remote Control Co., Ltd., 13 and 15, Evanston Avenue, Highams Park, London, E.4.—List No. 50 describing a new relay, type ACM.

Cryselco, Ltd., Kempston Works, Bedford. —1950/51 lamp catalogue, general price list, automobile price list and group 1 and group 2 broadsheets.

Birlec, Ltd., Tyburn Road, Erdington, Birmingham, 24.—Two of a series of leaflets covering all types of Birlec induction heating equipment.

English Electric Co., Ltd., Queen's House, Kingsway, London, W.C.2.—Four illustrated technical leaflets on S.S. circuit breakers, O.S. starters, O.S.R. starters and O.R. rotor starters.

Transradio, Ltd., 138a, Cromwell Road, London, S.W.7.—Illustrated leaflet TR-8B dealing with a new series of precision co-axial connectors including U.S. type connectors.

Newton & Co., Ltd., 72, Wigmore Street, London, W.1.—Illustrated and priced folder describing examples of the company's range of visual aid equipment.

W. T. Henley's Telegraph Works Co., Ltd., 51-53, Hatton Garden, London, E.C.1.—Catalogue C "Paper Cables in accordance with B.S. 480/1942". Catalogue J "Jointing Materials, Tapes and Compounds".

Railway Bogie Design

BOGIE design with particular reference to electric railways was considered in a paper presented by Mr. W. S. Graff-Baker, Chief Mechanical Engineer (Railways), London Transport Executive, at a general meeting of the Institution of Mechanical Engineers. The paper commenced with a review of past and current designs based mainly on common practice with a few references to less conventional variants.

The author next examined the dynamic characteristics of wheel sets and bogies as well as the various forces which act upon them in service operation, bearing in mind the kind of track provided and the need for its good maintenance. The fundamentals of bogie design were considered with particular mention of recent developments in methods of body suspension, problems of frame construction, braking, power transmission, etc. The paper concluded with a general survey of the subjects discussed in relation to the railways of the London Transport Executive.

Electrical Materials

Production and Price Trends in 1951

THE following is the customary survey of the course of production and prices during the past year of some of the principal materials employed in electrical manufacturing. It has been prepared for us by the Metal Information Bureau, Ltd.

COPPER.—The year opened with the copper supply position not particularly favourable as consumers in Britain were limited to a tonnage equal to the average of their monthly consumption of primary metal during the first six months of 1950; this worked out at something like 28,000 tons of virgin copper a month although meanwhile there had been a general increase in overall demand both from industrial users and for defence.

Despite a reduction in the American rate of stockpiling copper remained in short supply generally and in Great Britain official Orders were issued banning the use of copper and some of its alloys in the manufacture of a wide range of unessential articles in an attempt to conserve supplies available.

The lack of virgin copper was such that a very substantial demand accrued for secondary and some idea of the intense pressure can be gained from the fact that good quality copper *scrap* was being sold at more than electrolytic shapes produced from ore. The introduction of Scrap Control Orders later in the year, aimed at bringing scrap prices more into line with virgin metal values, resulted in a virtual drying up of business, largely owing to various loopholes in the Orders; thus the overall shortage of copper was aggravated by makers of secondary ingots finding difficulty in maintaining output.

In the main, consumers in this country were kept fully occupied within the limits of their raw copper allocations and demand for fabricated items continued to run ahead of the mills' ability to supply. During the first few months of the year the official copper price remained steady at £202 a ton because the American quotation, on which the U.K. quotation had been based for some time, was frozen at 24½ cents per lb. As a rule, copper consumers in this country obtained supplies at prices which compared favourably with those foreign users had to pay; on 1st April the Ministry's selling price was raised £8 to £210 a ton as a result of increased handling costs. On 25th May this price was further advanced to £234 a ton in keeping with an American decision to pay the Chilean producers an extra 3 cents a lb, but on 13th September it was reduced to £227 a ton following a Government decision not to make any further purchases for the time being of odd parcels of high-priced foreign metal. Thus reliance was to be placed on obtaining supplies from Empire countries, a policy which was criticized in some trade quarters: the outlook for improved supplies from Rhodesia, our biggest supplier, was brightening as the coal stumbling block was being surmounted.

OUTPUT OF MAIN COPPER AND ALLOY PRODUCTS IN THE UNITED KINGDOM*
(Long Tons, Copper Content)

	January 1950	October 1951
Unalloyed Copper Products :		
High conductivity products	165,761	161,512
Rods, bars and sections ..	4,597	5,468
Sheet, strip and plate ..	37,885	41,893
Tubes	33,270	37,289
Castings and miscellaneous ..	5,000	5,000
Alloyed Copper Products :		
Wire	9,974	10,760
Rods, bars and sections ..	66,321	65,463
Sheet, strip and plate ..	55,121	70,943
Tubes	9,815	9,969
Castings and miscellaneous ..	29,571	43,554
Copper sulphate	11,395	8,961
Total all products ..	428,710	460,812
of which:		
Consumption of virgin copper	268,435	273,025
Consumption of copper and alloy scrap (copper content)	160,275	187,787

(*British Bureau of Non-Ferrous Metal Statistics)

Meanwhile, Continental consumers of copper were paying very high prices in order to obtain metal and in the United States the shortage was acute, in the latter case being further aggravated by big strikes at producing properties; an effort to alleviate the pressure was made by the suspension of the 2 cents per lb import

duty until the middle of February, 1953.

Probably one of the outstanding events of the year was the agreement reached by the International Materials Conference to allocate world supplies; a quota of 677,160 metric tons of primary copper was decided on for the fourth quarter of 1951, of which the U.S.A. was entitled to consume 333,770 tons, the United Kingdom 91,690 tons, Germany 47,100 tons, France 36,490 tons, Canada 27,580 tons, Italy 24,200 tons, Belgo-Luxemburg 16,480 tons, Sweden 13,710 tons and Japan 13,200 tons (i.e., of home output and imports combined). Unfortunately the allocations were announced rather late for the fourth quarter but should act as a useful guide during the first three months of 1952.

TIN.—Unsettled conditions characterized the market in tin during the greater part of 1951, but it is true to say that although, over the period, prices varied widely, nevertheless the general level remained high—at above the £1,000 a ton mark; indeed at one time tin changed hands at over £1,600 a ton. The firm tone of the market was brought about by the unfavourable conditions prevailing in Korea and Malaya and, later, by developments in Persia. Spot metal continued throughout the year to command a premium over forward shipment and this at one time stood in the region of £270 a ton. The general scarcity of prompt supplies and the fact that United Kingdom consumption was pretty well balancing home output resulted in exports of English refined tin being held down to a minimum.

By far the biggest factor of importance during the year was the American announcement that outside purchases of tin for inclusion in the strategic stockpile were to cease from 6th March until the price of tin on the world market was reduced to a " reasonable level "—on 12th March the Reconstruction Finance Corporation became the sole importer of tin into America.

Throughout the remainder of the year the R.F.C. steadily reduced its buying price, although at no time was any indication given as to what it regarded as a " reasonable level "—many quarters in the trade inclined to the view that $1·03 per lb (£824 a ton) was the figure which might be in mind, as this was the escape figure in the United States contracts with the Dutch and Belgian tin producers. Thus for the best part of 1951 United States purchases of tin on the open market were held down to a negligible level, but towards the end of the year it became increasingly difficult to see how the R.F.C. could hold off the market for much longer—stocks were steadily declining, as also was the output of the Texas smelter in the continued absence of agreement between the R.F.C. and the Bolivian producers over the price to be paid for delivery of Bolivian ore to the smelter.

A good deal of market resistance was shown to prices falling below £1,000 a ton—a figure which many producers regard as reasonable having regard to present costs—while a sustained demand from Continental and South American countries also helped bolster values. Basically, of course, tin is a commodity in which potential output is in excess of consumption, but market conditions are affected by political factors as much as economic at the present time.

LEAD.—In general, consumers of lead in Britain during the past year found little real difficulty in covering their requirements, and although the Government decided fairly early in the year to limit consumers of virgin lead to 90 per cent of their 1950 monthly average consumption, it cannot be said that this caused any great hardship, in contrast to the position in copper and zinc.

The year opened with the Ministry of Supply's official maximum selling price standing at £136 a ton; on 1st April this was advanced to £160 a ton, on 14th July to £180 a ton, but on 1st October was reduced to £175 a ton. Thus consumers in this country were obtaining supplies at prices notably below those Continental users were having, and were prepared, to pay: metal for sale for payment in sterling commanded ready premiums abroad.

The imposition of the price-freeze in America and the doubling of the import duty there resulted in a shortage of lead to American consumers, since foreign sellers were able to dispose of quantities in other directions at higher prices—1951 imports into America showed a substantial decline compared with the preceding year.

The bulk of British needs come from Australia and some difficulties were caused during the middle months of the year as a

sult of coastal shipping hold-ups in the Commonwealth; however, by the end of 1951 these had been largely eliminated and the general lead supply outlook for consumers here was reasonably bright, affording it did some opportunity for building up stocks. United Kingdom lead consumption at the present time is running at about 26,000 tons a month, of which cables absorb something like 7,000 tons, sheet and pipe 5,500 tons and batteries 5,000 tons.

The broad situation in lead can be appreciated when it is realized that the International Materials Conference has not seen fit to introduce international allocation, thus leading to the assumption that lead is regarded as being in adequate world supply so far as defence, industrial and civilian requirements are concerned. So far as Britain is concerned, there has also been a steady improvement in the scrap supply position, thus enabling producers of secondary lead to offer good quantities of ingot to consuming industry.

There seems to be little likelihood of the reopening of the London Metal Exchange for dealings in lead, at any rate for the time being.

ZINC.—The year opened with the price of zinc in Britain standing at £151 a ton for virgin metal; the Ministry of Supply, the sole buyer and seller, made only two changes during the year—on 1st April its official quotation was advanced to £160 a ton and again on 14th July to £190 a ton. Throughout 1951, not only in this country but elsewhere as well, zinc was scarce; demand ran substantially ahead of availability, and as the defence programmes of the United Nations got under way, less and less zinc became available for ordinary industrial purposes.

Consumers in Great Britain were subjected to allocation in the matter of raw metal supplies and were unable to supplement their purchases by the acquisition of secondary zinc owing to the shortage of scrap; in order to conserve supplies as far as possible the Government here placed a ban on the production of a wide range of articles which called or the use of zinc in their manufacture.

In uncontrolled markets the price of zinc attained extremely high levels, at many times during the year being fully double the Ministry of Supply's price to users in Britain: as a result of these high prices Government purchases were cut to a negligible figure but when, later in the year, official interest was being shown in high-cost supplies, it was difficult to obtain even moderate tonnages. In the meantime the shortage of zinc, and also copper, was having the effect of hindering continuous operations at some manufacturing plants and, in the United States for example, some fabricators were forced to operate on a short-week basis. This was one of the factors which caused the American authorities to lower the zinc stockpile target and slow down the rate of acquisition. In Britain virgin zinc production was steadily maintained throughout the year, but difficulties attached to the shipment of concentrates from Australia; coastal shipping troubles in the Commonwealth also unsettled raw zinc shipments to the United Kingdom.

Total raw zinc imports into Britain during the first ten months of 1951 amounted to only 97,723 tons, compared with 119,972 tons in the same period of 1950. Towards the year-end the International Materials Conference in Washington agreed on world allocation quotas for the fourth quarter of the year; the total allocation of virgin zinc for this period was fixed at 469,260 metric tons, and of this total the United States was entitled to consume (that is, from domestic production and imports) 228,460 tons, the United Kingdom 60,250 tons, Germany 38,520 tons, France 27,660 tons, Belgo-Luxemburg 23,160 tons and other countries various smaller amounts. The consumption of secondary zinc was not affected.

ALUMINIUM.—The past year has witnessed a further strengthening of the position held by aluminium amongst the metals, and it is true to say that many users who have become used to the light metal in their manufacturing processes will not readily return to their original media as and when the supply position improves.

That aluminium has remained priced at £124 a ton throughout the year is a factor of considerable importance having regard to the way in which other metals have moved; on this alone a considerable strengthening in its competitive position has been achieved. The supply situation in this country has not been anything like so tight as in, say, copper and zinc, and it is really only in recent months that consumers

have found it seriously difficult to cover their important needs—and this in face of a substantial and growing demand for military purposes.

Home output has been maintained at around 30–32,000 tons of virgin metal a year; the bulk of the country's requirements have, therefore, had to be imported, as in the past, from Canada. The Ministry of Supply has entered into long-term contracts with the Canadian producer under which Great Britain is to receive first call on about 250,000 tons of ingot a year during the next twenty years; this country's basic supply of raw aluminium is therefore assured for some time, although at present defence needs must absorb substantial and increasing tonnages.

In the meantime, consideration is being given to the possibility of producing raw aluminium elsewhere within the sterling area, and steps are likely to be taken to this end in West Africa, although some time must elapse before the scheme comes to fruition. In Canada plans are going ahead for the production of aluminium on the west coast which, when completed, will substantially add to the Dominion's productive capacity. Very substantial increases in productive capacity are also being made in the United States, which will make it possible for that country to produce something like 1,000,000 short tons of virgin aluminium a year.

In Britain at present there is a substantial call for all semi-manufactured products and sheet in particular is now very difficult to procure. Scrap prices have had a maximum figure officially introduced, whilst in the case of secondary aluminium, leading refiners have imposed a form of voluntary price limitation.

IRON AND STEEL.—The year has seen the iron and steel industry beset with a number of serious difficulties. Imports of scrap have fallen to about 600,000 tons compared with around 2,000,000 tons in 1950. This, of course, has been a serious turn of events, but its effects might have been eased if pig iron production could have been stepped up sufficiently. Unfortunately, although a large amount of additional blast furnace capacity has become available, the utilization of much of it has been prevented by the coke shortage. Pig iron production has shown some improvement during the final months of the year, but it has been too late to prevent the lack of scrap from being reflected in steel ingot production.

Compared with a raw steel output of 16,293,000 tons in 1950, output in 1951 is not likely to have been above 15,750,000 tons and possibly below that level. Heavy rearmament requirements combined with large civilian buying have greatly increased the demand for steel during the year. With production down it is estimated that the gap between supply and demand is about 1,500,000 tons. Industry in general will feel the effect of this in 1952. Already some branches—notably the motor car industry—have been seriously affected by shortage of supply. Efforts have been made to secure steel from abroad, including 800,000 tons of ingots from the United States, but no great help can be expected until the middle of 1952. Steel has even been bought in Japan.

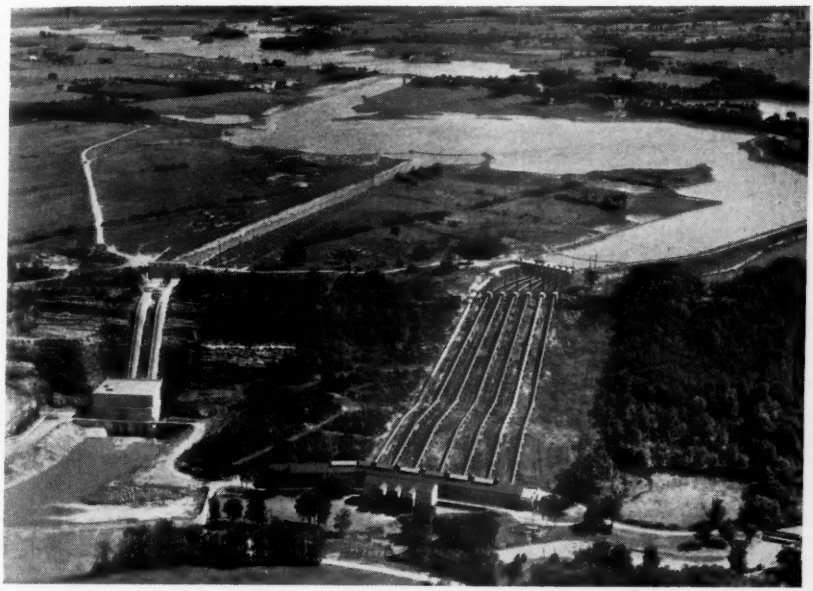
In such circumstances the reintroduction of a detailed allocation scheme for all types of steel, originally planned for December, but postponed until February, 1952, is inevitable but, in many ways, not uuwelcome.

In August domestic iron and steel prices were increased, following rises in the prices of raw materials, higher wages and increased fuel and transport costs. Export prices also advanced during the year, but they are now more or less nominal quotations, little new export business being taken at the present time.

RUBBER.—After rising to the highest level since 1911, No. 1 ribbed smoked sheet was quoted in London at 73d per lb for spot in February—the market moved steadily downwards to around 43d per lb by the middle of the year. From then on rather unsettled conditions prevailed owing to disturbed political conditions, the delays in the Korean peace talks, the situation in Malaya and conflicting reports on American stockpiling intentions. Towards the end of the year the possibility of shipping difficulties through the Suez Canal as a result of developments in Egypt made for a firmer market but subsequent movements have been narrow.

United Kingdom consumption of natural rubber in 1950 amounted to nearly 220,000 tons and during 1951 was at a rate of about 19,000 tons a month; Malayan production during the year was running at around 50,000 tons monthly.

Hydro-Electric Progress



Meeting Ontario's Industrial Expansion

IF electrical demand is an index to prosperity, no depression is visible in Ontario. During 1950 the Hydro-Electric Power Commission, in the words of its chairman, Mr. Robert H. Saunders, was faced with a " tremendous challenge." Soaring demands were reported from all parts of the province, from homes, farms, mines, factories and offices. Rapid expansion of all industries associated with the defence programme was a predominant factor during the latter part of the year. Exemplifying this activity were the increased demands of four steel concerns (66·7 per cent), three abrasive plants (77·1 per cent) and four metallurgical and electro-metallurgical plants (35·4 per cent).

Fortunately, the rise in demand of 426,755 kW (18 per cent) was matched by a correspondingly large addition to the Commission's plant capacity, namely, 448,100 kW (19·6 per cent). Within two weeks three new hydro-electric stations were officially opened—the 358,000 kW Des Joachims station on the Ottawa River (seven of the eight 45,000 kW units in service at the end of the year), the 42,000 kW George W. Rayner plant on the Mississagi River and the 60,000 kW Pine Portage development on the Nipigon River. Later in the year two of the eight 15,000 kW generators at the newly constructed Chenaux station on the Ottawa River went into service. To help in meeting the

The title picture shows the DeCew Falls plant at Thorold, Ontario. Additional diversion through the Welland Ship Canal authorized in 1950 provided a substantial increase in output

growing demand five emergency fuel stations, with an aggregate capacity of 61,000 kW, were commissioned and within recent weeks generation has commenced at the J. Clark Keith thermal station, Windsor, and the Richard L. Hearn station, Toronto (see *Electrical Review*, 2nd November, 1951).

At the end of 1950 the Ontario Commission operated sixty-four hydro-electric and six thermal stations with a peak capacity of 2,730,300 kW. Power produced and purchased reached the record total of 18,258·6 million kWh.

For the future, the potential capacity at Niagara and that of the international section of the St. Lawrence River are the only major sources of hydro-electric power within reasonable transmission distance of Southern Ontario—the main industrial centre—which remain undeveloped. One of the outstanding events during the year was the ratification by the United States Government of the Niagara Diversion Treaty, enabling the Commission to proceed with its plans for the development of additional power at Niagara, including the $182 million Sir Adam Beck-Niagara generating station. This project will comprise an intake above the Falls, a tunnel 5½ miles long leading to an open channel 2½ miles long and a power-house containing seven 75,000 kW units. The finished diameter of the tunnel will be 45ft.

Beyond 1956, harnessing of the St. Lawrence will become necessary. This requires action to implement the proposed St. Lawrence seaway and power project for which the Commission continues to press. Some 6,300 million kWh annually could be obtained by this means.

Electricity Cheaper than Pre-War

The Commission supplies power through three systems covering almost the whole of the 363,282 sq miles of Ontario's land area. At the end of the year under review consumers (municipal, rural and direct) numbered 1,187,320. To serve them the Commission built an additional 1,918 circuit miles of h.v. and l.v. lines. Domestic users in urban centres consumed on the average 3,648 kWh in 1950, paying 1·04 cents/kWh—less than in 1938 (1·28 cents) although the cost of living in Canada has since then risen by nearly 88 per cent.

In 1946 a five-year rural electricity plan was put in hand and has now been completed, the programme being greatly exceeded. The extent of this work is shown by the fact that at the end of 194[illegible] rural consumers numbered 156,560, the network comprising 21,569 miles of line while in 1950 there were 292,811 consumers and 34,793 miles of line. It is estimated that of all the farms in the province 67 per cent had an electricity service at the end of 1950. They used on an average 3,192 kWh compared with 2,196 kWh in 1945.

A major task confronting the Commission is the conversion to the standard 60 c/s frequency of the 25 c/s system in an area of 12,000 sq miles of Southern Ontario. In 1950, the second year of the scheme, the work was accelerated. The standardization staff of the Commission itself numbered 1,096 while the Canadian Comstock Co., which is carrying out the actual changeover, had 2,394 employees engaged on the conversion. By the end of the year 343,000 of the more than 4,000,000 pieces of apparatus involved had been changed over.

Research Work

Among the many activities of the Research Division, steady progress was made in the improvement and application of such recent developments as the linascope, the bolometer, the temperature-rise simulator and the soniscope. For the last-named instrument, which enables the condition of concrete to be studied non-destructively, two of the Commission's research engineers were awarded the American Concrete Institute's Wason Medal.

Laboratory and field tests indicated the superiority of a new thermostat for domestic water heaters and its use in future installations was recommended. Field tests of an experimental hay dryer were conducted and the possibility of using the heat pump principle for crop drying was considered but rejected on economic grounds. The domestic application of equipment of this kind is, however, being studied at the University of Toronto where an experimental heat pump has been installed.

The fiscal year of the Commission has been changed so as to end on 31st December, and the accounts therefore cover a 14-month period. Revenue aggregated $91·7 million and because of the favourable load growth the Commission was able to make a substantial rebate ($3·4 million) to municipalities of the Southern Ontario and Thunder Bay Systems.

New Zealand's Power Policy

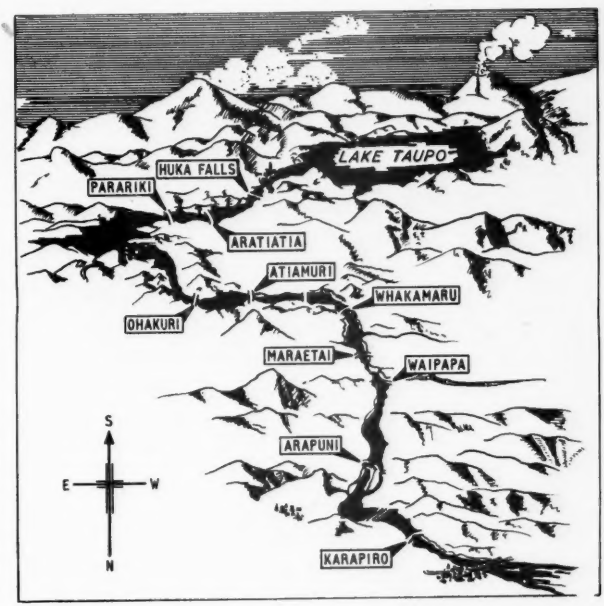
State Hydro-Electric Department's Report

BECAUSE of the power shortage which has been experienced in New Zealand the installation of steam plant has been considered. It is felt, however, that the development of the country's hydro-electric resources provides the most economic solution and the main efforts of the State Hydro-Electric Department will continue to be directed to speeding up the schemes now under construction.

Though steam plant development will not be undertaken if it can be avoided, explorations are proceeding for the location of possible coal measures. Great importance is also attached to the search in the North Island for geothermal steam (*Electrical Review*, 28th December, 1951). Success in this field, says the Department's general manager (Mr. A. E. Davenport, B.E., M.I.E.E.), would have immense economic advantages for New Zealand; it would provide a ready means of "firming up" the hydro-electric power as well as yielding a source of further power for the future.

Summarizing the progress made on the various projects, the report states that at Maraetai, one of the developments on the Waikato River, good headway has been made after a setback of some months caused by industrial troubles. It is hoped that it may be possible for three turbines to be run at about half the normal head by next October, and that the full output of 108,000 kW may be obtained from these machines by the end of the year; the remaining two turbines are due for completion in the first half of 1954. The Whakamaru scheme is scheduled for first operation in 1955, though progress is dependent upon steel supplies and the manpower available. At Waipapa, investigation work was essentially completed during the year, and overseas consultants were engaged upon the design of the Atiamuri and Ohakuri projects.

In the South Island lack of manpower has held up the Cobb scheme. It is expected that the power-house will be ready by the middle of 1953, but the main dam may not be finished for another year. A 25,000 kW set went into operation at Tekapo and work



Waikato River hydro-electric development

Huka Falls (65ft, 40,000 kW), Pararíki (35ft, 20,000 kW), Aratiatia (110ft, 60,000 kW), Ohakuri (137ft, 100,000 kW), Atiamuri (73ft, 50,000 kW), Whakamaru (120ft, 100,000 kW), Maraetai (200ft, 180,000 kW), Waipapa (63ft, 50,000 kW), Arapuni (175ft, 145,000 kW), Karapiro (100ft, 90,000 kW)

is in progress on the control dam. The installation of two new units at Waitaki is behind schedule and this also applies to Roxburgh; in both cases measures are being taken to speed up the work so that it may be completed in accordance with plans (in 1954 and 1956 respectively).

An extensive programme of transmission line construction is in hand. Of the 2,000 miles of line being built or planned, nearly 1,300 miles is for the North and South Island 220 kV main transmission system. The first line at this voltage from the Waikato to Auckland has been completed and the initial circuit to Bunnythorpe should be finished by the time that the Maraetai plant is commissioned.

From an operational point of view the year 1950–51 was notable for the way in which difficulties were overcome and more power was generated than in any previous year. This was achieved partly by greater production at thermal and auxiliary plants: State hydro-electric stations generated 2,643·5 million kWh (against 2,688·6 million in 1949–50) and fuel stations 148·5 million kWh (47·9 million), in addition to which 150·4 million kWh (134·3 million) was purchased. One consequence of the greater thermal plant output was that running costs were increased. Generating expenses, in fact, rose from £897,572 to £1,473,032. After taxation the profit fell £80,448 short of the amount required to meet the full loan redemption charge. Capital expenditure during the year amounted to £8,266,378.

The Rural Electrical Reticulation Council received a further 96 applications for subsidies. Up to the end of March last subsidies had been approved on 1,806 route miles of line which, when completed, will supply some 3,185 consumers. The capital expenditure involved amounts to £1,016,786, the annual subsidies approved totalling £49,381. So far 731 miles of line have been constructed and 1,429 consumers connected, the majority being farming properties. Shortage of materials, particularly hardwood poles, is at present hindering the progress of the work.

Reporting on the work of the Electrical Wiremen's Registration Board, it is stated that candidates for the electrical wiremen's examination numbered 1,144 and for the various servicemen's examinations 370. New registrations numbered 415 (electrical wiremen 302). It is also noted that 133 provisional licences were issued in consequence of the influx of tradesmen from Great Britain, Australia, South Africa and Holland.

Schoolboys' Exhibition

THE Electrical Development Association's exhibit is again one of the main centres of attraction at the Schoolboys' Own Exhibition which until 12th January is being held at the Horticultural Halls, Westminster. By means of animated dioramas the story is told of the production of electrical power from coal and the boys are invited to emulate the miner at a "try your strength" machine, the strength of a blow by a mallet being recorded and representing the boy's "power potential."

To translate his "power potential" into terms of electricity, push-button machines illustrate various applications of electricity in the home, the factory, the farm and in transport. A boy with a score of 14, for instance, discovers that his "output" of coal will keep a 1 kW fire burning for fourteen hours, will provide power for milking twelve cows twice a day for fourteen days, will silver-plate 42,000 teaspoons or will propel a trolley-bus 10,556 yards. An added attraction this year is a competition in which prizes are offered for essays describing the electrical stand.

On the Royal Navy stand the extent of use of electrical equipment is shown by a model of an aircraft carrier in which it is indicated that the installation comprises 500 motors, 110 generators, 880 batteries, 300 radiators, 250 circuit breakers, 7,500 lamps, 3,500 radio valves, 30 radio transmitters and 400 miles of cable.

Large-scale models of an M. & C. "Samson" stripper, a "Meco-Moore" cutter loader and a long-wall coal cutter represent electrical equipment employed in coal mining, while British Railways have arranged an elaborate electrified model of a typical portion of its system. The G.P.O. exhibits include examples of special types of cables used, a frequency invertor and a teleprinter.

Poultry incubators and brooders and a model grass drying plant are included in a farming exhibit, and among other notable displays are the latest radio controlled automatic pilot for pilotless planes (Ministry of Supply), a model ice cream plant (J. Lyons & Co., Ltd.) and a display of Smiths clocks in which an electric model made in 1848 is prominent. On another stand boys are invited to hear their own voices with the aid of Thermionic Products recording equipment.

ELECTRICITY SUPPLY

Peat-Fired Gas Turbine

Scottish Transmission Scheme

USE of Scotland's vast peat resources for industrial purposes, with consequent development of remote Highland areas, is envisaged with the completion of experiments at Clydebank on what is believed to be the world's first peat-burning gas turbine. The advanced stage which these experiments have reached was seen by members of the Scottish Peat Committee who visited John Brown & Co.'s engineering workshops at Clydebank recently. Experiments have been undertaken by John Brown & Co., under contract from the North of Scotland Hydro-Electric Board, in the hope that a commercial plant for the production of electricity may ultimately be developed.

The gas turbine, a 500 h.p. closed-cycle type, can be run on peat of any moisture content up to 50 per cent. In the course of the next year, however, further drying equipment is to be installed to enable the plant to take peat of a higher moisture content without loss of efficiency. The Scottish Peat Committee is now investigating a process of removing water by pressure and the first of two new presses developed by the Royal Technical College, Glasgow, is to begin operating in the Falkirk area early this year.

House Installations

Barnard Castle R.D.C. has asked the North Eastern Electricity Board to send a representative to discuss the supply of electricity to 23 dwellings at Grievsons Place. The Council had been informed by the Board that owing to capital restrictions it would not be possible to do the work at present, even though the premises, being without gas supplies, qualified for special consideration.

N.C.B. Distribution Network

The North Eastern Electricity Board and the National Coal Board are to inspect the low voltage system in the Easington (Co. Durham) area at present owned by the Coal Board and about the condition of which complaints have been made recently. It is expected that eventually the network will be incorporated

This recent photograph of a section of the 132 kV transmission line between Fasnakyle and Fort Augustus was chosen by the J. L. Eve Construction Co., Ltd., as a Christmas card illustration, with the title "No Highway." No roads existed for eight miles and the company (the contractors) laid their own track, skirting Loch na Beinne Baine at an altitude of 1,838 ft. The transmission line tower at this altitude is believed to be at the highest point above sea level in Great Britain for construction of this class. The work was carried out for the North of Scotland Hydro-Electric Board, the consulting engineers being Messrs. Kennedy & Donkin

into the system of the Electricity Board, but no agreement has been possible so far to bring about the transfer. The Coal Board, it is understood, is reluctant to spend any considerable amount improving the network unless there is some recompense for the extra expenditure when the North Eastern Electricity Board takes over the system.

Rural Development

Meeting at Dunfermline under the chairmanship of the Countess of Elgin, the Fife Local Committee of the S.E. Scotland Electricity Consultative Committee noted with regret that restrictions on capital expenditure would prevent the Area Board from undertaking any rural development apart from existing commitments provided for in its current year's programme. It was agreed to recommend that some relaxation of this policy should be permitted.

Members were informed that, as a result of the Committee's earlier representations, the Board had been advised by the Ministry to reapply at the end of the current financial year for permission to make an electricity supply available to houses at Rossend, Burntisland. At present these houses have only a very inadequate gas supply and so far the Minister has refused to allow conversion to electricity.

Scottish Transmission Lines

Mr. James Stuart, Secretary of State for Scotland, has confirmed a scheme, prepared by the North of Scotland Hydro-Electric Board, for the erection of overhead transmission lines between new transforming stations at Strathleven, Dumbartonshire, and Kepculloch, Stirlingshire. They will provide electricity to the British Electricity Authority from the transmission lines between Loch Sloy (Dumbartonshire) and Windyhill, to meet growing requirements in the Dumbarton area, and augment the electricity supply in Stirlingshire and other parts of Dumbartonshire. The scheme is estimated to cost £343,000. All objections to it were withdrawn, and no observations were made on it by the Amenity Committee. A white paper on the scheme has been published by H.M. Stationery Office.

East Midlands Consultative Council

THE forecast of a likely further increase in the price of electricity by the middle of 1952 was made by Mr. C. R. King, chairman of the East Midlands Electricity Board, at the fourteenth meeting of the East Midlands Electricity Consultative Council at Nottingham on 19th December. The increase had got to come, he said, because the price of coal was going up, wages and salaries had risen substantially and further increases were under discussion. The Board could not maintain the ¾d follow-on charge very much longer.

Mr. King added that the Board was exercising the strictest economy and no additions to the establishment were permitted without the express consent of the chairman or deputy chairman. Nevertheless, the chances were that in its fourth year the Board might find itself "in the red." The grid tariff increase from £3 10s to £3 15s/kW had resulted in the Board's costs being increased by £240,000. A further submission by the B.E.A. of a 5s increase had been resisted by Area Board chairmen, who considered that any increase should not exceed 2s 6d. The B.E.A. surplus needed to be cut to the bone.

Mr. F. V. Pipe (Derby) questioned whether the Board should re-examine its policy regarding credit sales of electrical apparatus. He raised the matter because at present, in the national interest, banks were curtailing facilities for capital for hire purchase in ordinary industries.

Mr. N. F. Marsh, chief commercial officer, said that the Board was not going out of its way to publicize the credit sales scheme. The scheme for the Area was created in 1949 as a facility for the credit consumer and to replace a number of different schemes. Based on the figures for the first seven months of the current financial year, the rate of credit sales was slightly lower than in the previous year despite increased prices. He pointed out that the scheme required no appreciable additional capital; instalments on past sales were practically covering expenditure on new apparatus.

After hearing an assurance from the chairman of the Board that the Board was not keen to promote new sales, but only to give the best possible service to consumers, the Council felt that it should not make any representations on this matter.

Considering measures to reduce fatal accidents in the home due to faulty electrical apparatus, the Council decided to support proposals recommended by the Leicestershire and Warwickshire Committee. In discussing these measures, Mr. C. F. Freeman (Coventry) suggested that an annual maintenance charge of 10s or £1 might be instituted for repairs to electrical equipment.

Mr. Marsh said this was being done in a limited way with the credit sales scheme. At present there was insufficient staff to cope with any extension as suggested.

A report on the Council's work during its three years showed that consideration had been given to 308 representations from consumers. It was noted, however, that despite the helpful co-operation of the Press, many consumers seemed to be unaware of the existence of the Consultative Council machinery.

NEXT WEEK'S EVENTS

Monday, 7th January

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Centre. "The Protection of Electrical Power Systems—A Critical Review of Present-Day Practice and Recent Progress," by H. Leyburn and C. H. W. Lackey.

BRISTOL.—I.E.E. Western Utilization Group. Annual dinner.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North-East London Branch. Discussion on the 12th Edition of the I.E.E. Rules.

LEEDS.—At the Lighting Service Bureau, 7.30 p.m. A.S.E.E. Leeds Branch. "Very High Frequency-Radio-Telephone Systems in Commerce and Industry," by M. Evans.

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey & North Wales Centre. "Modern Developments in Electric Welding," by Dr. H. G. Taylor.

LONDON.—Café Royal, W.1, 6.30 for 7 p.m. I.E.E. Measurements Section. Section dinner-dance.

NEWCASTLE-ON-TYNE.—King's College, 6.15 p.m. I.E.E. North Eastern Radio & Measurements Group. "The Automatic Monitoring of Broadcast Programmes," by H. B. Rantzen, F. A. Peachey and C. Gunn-Russel.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Portway Earthing System," by F. Porter.

Tuesday, 8th January

BELFAST.—Presbyterian Hostel, 6.45 p.m. I.E.E. Northern Ireland Centre. "The Development of the Electrical System on the Bristol 'Brabazon' I Mark I Aircraft" by M. J. J. Cronin.

LEEDS.—B.E.A. Offices, 1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "Crystal Diodes," by R. W. Douglas and Dr. E. G. James. "Crystal Triodes," by T. R. Scott.

LIVERPOOL.—Mersey & N. Wales E.B. Service Centre, Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "Brightness Engineering," by W. Robinson.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements and Radio Sections. "Two Electronic Resistance or Conductance Meters," by Dr. L. B. Turner. "A Bridge for the Measurement of the Dielectric Constants of Gases," by W. F. Lovering and L. Wiltshire.

At the Royal Society of Arts, John Adam Street, W.C.2, 6 p.m. Illuminating Engineering Society. "Lenses for Lighthouses," by Dr. W. M. Hampton.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "Electricity in Newspaper Printing," by A. T. Robertson.

WIMBLEDON.—L.E.B. Showroom, 14 The Bridge, 8.15 p.m. A.S.E.E. South-West London Branch. Ladies' Invitation Night. "Electricity in the Home," by Miss G. Pledge and Mr. H. C. Allen.

Wednesday, 9th January

ABERDEEN.—Caledonian Hotel, Union Terrace, 7.30 p.m. I.E.E. North-East Scotland Sub-Centre. "The Operation and Maintenance of Television Outside-Broadcast Equipment," by T. H. Bridgewater.

BIRMINGHAM.—James Watt Memorial Institute, 6.45 p.m. I.E.E. South Midland Students' Section. "Hydrogen Cooled Alternators," by T. O. Jones.

BRADFORD.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "Further Applications of X-Ray Treatment," by F. Hudson.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. Scottish Centre. "Transient Theory of Synchronous Generators connected to Power Systems," by B. Adkins.

Welfare Club Hall, City Lighting & Cleansing Department, 7 p.m. I.E.S. Edinburgh Centre. "Measurement of Light in the 18th Century," by H. Buckley.

LONDON.—School of Hygiene & Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. "Crystal Triodes," by Dr. E. G. James and G. M. Wells.

MANCHESTER.—Engineers' Club, Albert Square, 6.30 p.m. I.E.E. North-Western Radio Group. "Analogies," by Prof. M. G. Say.

NEWCASTLE-ON-TYNE.—Newe Theatre, Pilgrim Street, 6.15 p.m. I.E.S. Newcastle Centre. "Development of the Tungsten Lamp," by B. P. Dudding.

OXFORD.—S.E.B. Showrooms, 37, George Street, 7 p.m. I.E.E. District meeting. "Type Testing of Domestic Electric Equipment," by H. F. Watson.

PRESTON.—Harris Institute, Corporation Street, 7 p.m. I.E.E. North Lancashire Sub-Centre. "The Design and Performance of Surge Divertors for the Protection of Alternating-Current Systems," by T. F. Monahan.

SOUTHAMPTON.—Polygon Hotel, 6.30 p.m. I.E.E. Southern Centre. "Domestic Electrical Installations: Some Aspects of Fire Risks," by H. W. Swann.

YORK.—Feasgate Restaurant, 7.30 p.m. A.S.E.E. York Branch. "Design and Installation of Lightning Conductors," by E. Fuller.

Thursday, 10th January

CARDIFF.—Sophia Gardens Pavilion, 6.30 p.m. I.E.E. Western Centre. Faraday Lecture. "Sound Recording—Home, Professional, Industrial and Scientific Applications," by Dr. G. F. Dutton.

CHIPPENHAM.—At the Works of Westinghouse Brake & Signal Co., Ltd., 6.30 p.m. I.E.E. Bristol Students' Section. "Electronic Control of Electrical Machines," by N. Meadows.

DUNDEE.—Royal Hotel, Union Street, 7 p.m. I.E.E. North-East Scotland Sub-Centre. "Operation and Maintenance of Television Outside-Broadcast Equipment," by T. H. Bridgewater.

GLASGOW.—At the Institution of Engineers & Shipbuilders, 39, Elmbank Crescent, 6.30 p.m. I.E.S. Glasgow Centre. "The Development of the Tungsten Lamp," by B. P. Dudding.

LEEDS.—B.E.A. Yorks. Division Offices, 1, Whitehall Road. E.P.E.A. West Yorkshire Technical Group. "Industrial Education and Training in the U.S.A.", by A. M. F. Palmer.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "Electricity in Newspaper Printing," by A. T. Robertson. (Utilization Section paper.)

(Continued on next page)

Thursday, 10th January *(continued)*

MANCHESTER.—Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. Members' Night.

RUGBY.—Laurels Club, Dunchurch Road, 7.30 p.m. I.E.E. Rugby Students' Section. Film evening.

SWANSEA.—Central Library, Alexandra Road, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. Address by J. W. Elliott, chairman of the Western Centre.

TYTHING.—Talbot Hotel, 7.15 p.m. Worcester Electric Club. "Relays and Remote Control," by Dr. Stern.

Friday, 11th January

BIRMINGHAM.—Imperial Hotel, Temple Street I.E.S. Birmingham Centre. Annual dinner.

CREWE.—Crewe Arms Hotel, 7.15 p.m. A.S.E.E. Crewe Branch. "Electronics in Industry," by C. N. W. Reece.

LONDON.—At the Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 7 p.m. Institution of Electronics. "Pulse Testing for Television and other Wide-Band Apparatus," by M. V. Callendar.

Feathers Hotel, Broadway, Westminster, S.W.1 6 p.m. Electrical Trades' Commercial Travellers Association. General meeting.

NOTTINGHAM.—Electricity Showrooms, Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch "Transformers," by E. P. Byrom.

STOKE-ON-TRENT.—M.E.B. Showrooms, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "The Development of the Electrical System on the Bristol 'Brabazon' I Mark I Aircraft," by M. J. J. Cronin.

NEW BOOKS

Principles of Alternating Currents. By W. Sluckin. Pp. 320; figs. 165; index. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 10s 6d.

The ordinary text-book on alternating currents is generally beyond the capabilities of the many electrical engineers who have not had the opportunity of studying pure science and mathematics including trigonometry and the calculus. Here is a book which seeks to overcome this difficulty and succeeds admirably in the attempt.

Starting with a brief account of the nature of electric currents which permits of a discussion on the relative advantages of a.c. and d.c., the author gives the basic theories of alternating currents taking the elements of trigonometry, graphical presentation and vector arithmetic in his stride. Thence, it is no longer difficult to elucidate the mysteries of such things as polyphase currents, power factors and so on. The interest of the reader is maintained by frequent references to the more practical side of the subject and, in dealing with the problems of generation, Mr. Sluckin even takes the opportunity to give a brief description of steam and water turbines. In the applications of electricity he is thoroughly up-to-date, dealing with electronics including rectifiers and the cathode ray oscillograph as well as discharge tube lamps and induction heaters.

The author has succeeded in giving in a most lucid manner a comprehensive survey of his subject in a relatively small compass, and to indicate how completely he has dealt with each part of his task, he includes a number of numerical examples (with answers), many of which would grace any advanced examination paper on the subject. The book can be recommended to engineer and student alike.—A.R.

Manual for the Illuminating Engineer on Large Size Perfect Diffusers. By H. Zijl. Pp. ix+196; figs. 120, charts and index. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 30s.

Formulæ for the illumination due to line and surface sources are scattered throughout the literature of illuminating engineering and their practical importance has been increased by the coming of the fluorescent lamp and by the growing interest in daylight calculations. The author has not simply collected these formulæ but he has derived them from first principles, confining himself, as far as surfaces are concerned, to rectangles and omitting all mention of circular or elliptical discs.

Probably the most valuable feature of the book is the series of 49 diagrams by means of which calculation from the formulæ applicable to any particular case is reduced to two simple operations, viz., a reading from the appropriate diagram and then a simple slide-rule operation. Several chapters are devoted to the use of the formulæ in typical illumination problems, a particularly useful one being that which describes, *inter alia*, the calculation of sky factors in designing for daylight. Here again, diagrams are provided to simplify the work. The book can be recommended to any whose work involves the solution of such problems as those which have been mentioned.—J.W.T.W.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Brook Motors, Ltd.—The annual meeting was held on 22nd December, Mr. F. V. Brook (chairman and joint managing director) presiding. In his circulated statement the chairman said that the past year had resulted in their production figures attaining new records. In the case of industrial motors of from 1 to 250 h.p. the increase had been nearly 50 per cent, for fractional h.p. motors 50 per cent, and control gear nearly 300 per cent. Their order book at the present time was very heavy, but a further improvement in their production rate would depend upon the quantity of materials which became available. Their venture in the Canadian and United States markets had steadily expanded. A new American company had been formed in California with the present directors on the board. At the moment it was not being operated owing to the difficulty of manufacturing sufficient quantities of special motors required for that market, caused by the shortages of the necessary materials. They were, however, selling a limited quantity of their motors there through a sales organization which was eventually prepared to work in conjunction with their American company. Their new factory at Barnsley was rapidly taking shape and it was estimated that by next spring they would commence production there.

Electric & Musical Industries, Ltd.—In the course of his speech at the annual meeting held on 20th December, Sir Alexander Aikman (chairman) said that although it had so far been possible to provide adequate finance for expansion of the business by making arrangements with their bankers, the rate of production continued to rise and more permanent arrangements must now be made. The directors had under examination a proposal to meet the situation by an issue of ordinary shares by way of an offer to existing stockholders, and an application had been submitted to the Treasury in this respect. A more definite announcement on this subject would be made at a later date. Reviewing the general business of the group, the chairman said that during the past year the demands on their research, development and manufacturing facilities had been so great that they had been compelled to provide further factory accommodation in various parts of the country and their needs in this direction were not yet entirely filled. Their research and development in the sphere of television and sound relay services had enabled them to conclude a long-term arrangement for the manufacture of the terminal receivers required by the foremost organization operating relay services at home and overseas for their wired television service. From 30th June to 30th November last the turnover of the group showed an expansion of 26 per cent for the English companies and latest returns from the overseas and foreign companies showed an increase of 34 per cent. They had manufactured at their factories the television transmitters for the new stations at Kirk o'Shotts, Scotland, and the Western region transmitter to be sited at Wenvoe, outside Cardiff; both these were to be installed in 1952.

In the field of development of atomic energy, the chairman said their research team had developed a multiplier photocell which was in demand in many countries for the detection of radiation. At the recent National Radio Exhibition, they exhibited a television receiver with a 21in screen which was now in course of production. They had increased their radio receiver business based on exports from this country. Exports from the United Kingdom and sales made by the British overseas and foreign subsidiary companies were a most important aspect of their business, this trading representing 56 per cent of the total group turnover.

The Automatic Telephone & Electric Co., Ltd., is holding meetings on 10th January at which proposals will be submitted for increasing the capital to £3,560,000 by the creation of 1,000,000 ordinary shares of £1 each. Subject to the permission of the Capital Issues Committee, it is proposed, when conditions are favourable, to make an issue to ordinary and deferred stockholders of a proportion of the new shares.

Richard Johnson & Nephew, Ltd., held an extraordinary meeting on 21st December at which a resolution was passed authorizing a bonus issue of 900,000 £1 ordinary shares in the proportion of one for every ordinary share held.

Lightfoot Refrigeration, Ltd., has declared an interim dividend of 3 per cent (unchanged).

International Combustion Africa, Ltd., in a preliminary statement, reports a trading profit for the year to 30th September last of £119,367, as compared with £55,822 for 1949-50, and a net profit, after providing

£15,211 for depreciation and £29,000 for taxation, of £77,872 (against £35,931). The dividend is maintained at 25 per cent by a final payment of 15 per cent, but is payable on increased capital.

New Companies

G. E. Bell, Ltd.—Registered 11th December. Capital £1,500. Importers, exporters and manufacturers of and dealers in electrical goods, radio and television sets, etc. Directors: G. E. Bell and Sarah Bell. Secretary: Sarah Bell. Regd. office: 173, Earls Court Road, S.W.5.

Caldwell Electro-Mechanisms, Ltd.—Registered 11th December. Capital £2,500. To acquire the business of electro-mechanical apparatus carried on by T. F. Caldwell at Progress Way, Waddon. Directors: G. P. Dean, director of A. E. Dean & Co. (X-Ray Apparatus), Ltd.; and T. F. Caldwell. Secretary: Rhoda W. Caldwell. Regd. office: Progress Way, Waddon, Surrey.

W. Sagar (Contractors), Ltd.—Registered 10th December. Capital £1,000. To acquire the business of an electrical contractor, carried on by W. Sagar at Smithies, Barnsley. W. Sagar is permanent managing director. Secretary: Emma Sagar. Regd. office: 82R, Wakefield Road, Smithies, Barnsley.

Aadu, Ltd.—Registered 18th December. Capital £1,000. Manufacturers of electrical, electronic and mechanical apparatus and accessories, etc. Directors: F. Youle and G. Haldane. Regd. office: 10, Old Square, Lincoln's Inn, W.C.2.

Scunthorpe Radio Relay Service, Ltd.—Registered 18th December. Capital £10,000. To establish and operate radio and television relay services within the area of the Scunthorpe Corporation. Directors: J. W. C. Robinson, Hilda Robinson, W. G. Thomas and T. J. Lockyer. Regd. office: Bush Lane House, Bush Lane, Cannon Street, E.C.4.

Miller & Peters (Electrical Contractors), Ltd.—Registered 21st December. Capital £1,000. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Directors: D. C. Miller and L. Peters. Regd. office: 154, Stoke Newington Church Street, N.16.

Increases of Capital

F. H. Pride, Ltd.—Increased by £20,000, in £1 ordinary shares, beyond the registered capital of £10,000.

B. M. Ryder, Ltd.—Increased by £4,000, in £1 ordinary shares, beyond the registered capital of £1,000.

Alger's Wholesale Supplies, Ltd.—Increased by £10,000, in 2,500 ordinary and 7,500 7½ per cent non-cumulative redeemable preference shares of £1 each, beyond the registered capital of £5,000.

Bankruptcies

W. R. Eagle, lately carrying on business at 10, Houghton Chambers, 1, Houghton Place, Liverpool, electrical contractor.—First meeting to-day (Friday) at the Official Receiver's office, West Africa House, 28, Water Street, Liverpool. Public examination 12th February at the Court House, Victoria Street, Liverpool, 2.

A. Parker, 119, Ravensthorpe Road, Dewsbury, Yorks, formerly residing and carrying on business at 93, Newsome Road, Huddersfield, electrical engineer.—Order made 14th November suspending discharge for 14 days until 28th November, 1951.

J. L. Rose, 9, Wades Hill, Winchmore Hill, London, N.21, electrical engineer.—Last day for receiving proofs for dividend to-day (Friday). Trustee, Mr. W. J. Wallis Hill, 3, Central Buildings, Matthew Parker Street, London, S.W.1, Official Receiver.

J. R. Short, formerly carrying on business at 11, Rutland Avenue, Bishop Auckland, Durham, electrical contractor.—Receiving order made 20th December on debtor's own petition.

F. Robinson, residing at 46, Glovers Road, Small Heath, Birmingham, and lately carrying on business at 100, Henshaw Road, Small Heath, Birmingham, as a refrigerating and electrical engineer.—Last day for receiving proofs for dividend 15th January. Trustee, Mr. R. K. Clark, Somerset House, 37, Temple Street, Birmingham, 2, Official Receiver.

E. P. Hallybone, 15, Kneesworth Street, Royston, Herts, radio dealer and electrical engineer.—Supplemental dividend of 9¼d in the £, payable on or after 10th January at the Official Receiver's office, 41, Sidney Street, Cambridge.

P. H. Leach, 4, Oxford Street, Guiseley, near Leeds, radio and electrical engineer, lately carrying on business at 4, Oxford Street, Guiseley, and at 6 and 8, Town Street, Yeadon, Yorks.—Last day for receiving proofs for dividend 11th January. Trustee, Mr. K. Russam, 2a, Tyrrel Street, Bradford.

J. S. Anderson, trading as "Electronic Services," at Nearavon, Salisbury Street, Fordingbridge, Hants, radio and electrical engineer.—First dividend of 3s 2d in the £, payable at the office of Mr. A. H. Brown, The Square, Fordingbridge.

Liquidation

Haden Electrical, Ltd.—Winding up voluntarily. Liquidator, Mr. R. M. Patel, 1, Queen's Gardens, London, W.2.

STOCKS and SHARES

THE New Year has started in the Stock Exchange markets in a state of somewhat subdued cheerfulness. Prices remained quiet, in the absence of any noticeable expansion of business. Prospects hardly flatter the hope of early material improvement, and the shadow of E.P.T. lays a hand of restraint upon employment of fresh capital in the purchase of stocks and shares. Nevertheless, the heavy selling which took place in December and caused widespread depression amongst most of the markets has come to an end, and has been succeeded by a little investment buying. Prices now stand at levels which offer temptation to the buyer who is prepared to disregard immediate fluctuations, and to take the long-term view with the idea of better things to come.

Highs and Lows

By way of supplement to the tables given here last week, to compare end-of-the-year prices with those at the beginning, the following list gives current prices against the highest and lowest recorded during 1951 up to mid-December. Gilt-edged securities, as represented by British Electricity Authority issues, have been in a more or less continuous decline throughout, with a heavy drop in the closing stages, so that, unhappily, to-day's prices are mostly at the year's lowest point. Industrial ordinary shares were generally at their lowest at one extreme of the year or the other: their peaks came either just before the General Election or, more generally, during June. For them, the first half of the year was a period of almost uninterrupted progress, which numbers of people expected—very mistakenly, as it happened—to be given a new stimulus by a change of Government.

Stock or Share	1951 To mid-Dec. High	Low	1951 End-Dec.
Brit. Elec. 3½% 1976-9 ..	103¾	91¾	89½
do. 3% 1974-7 ..	96¾	86	83½
A.E.I.	£5	80/9	83/9
Automatic Tel.	74/9	61/3	63/9
Babcock	83/3	66/9	70/6
B.I.C.	37/9	30/6	30/–
Crabtree	44/3	35/9	34/6
Crompton P.	13/–	10/–	10/–
E.M.I.	25/–	17/9	18/–
English Electric	74/3	47/3	58/9
G.E.C.	99/6	81/3	91/6
Hackbridge & H.	18/7	15/4	16/3
Henley's	27/6	20/–	21/–
Hoover	34/3	24/9	27/3
Johnson & Phillips	68/3	55/3	56/3
Lancs. Dynamo	56/3	45/–	43/9
Lucas	47/–	33/7	36/3
Reyrolle	49/9	37/6	43/–
Siemens	52/–	31/3	39/6
Tube Investments ..	£7 3/8	£5¾	£5½
West, Allen	14/5	10/6	10/9

These figures allow for capital bonuses, but not for "rights" issues.

New Issues

Automatic Telephone & Electric and Morphy-Richards were among the companies which announced new capital plans in the week before Christmas. Automatic Telephone are to take powers, at meetings to be held early in the year, to create a further million £1 ordinary shares, of which it is the intention to issue a proportion when conditions are favourable. Terms are not specified. The existing ordinary shares have eased to 63s 9d and the "B" deferred to 62s 6d. Morphy-Richards have offered ordinary shareholders new 4s shares at 14s on a one-for-ten basis; they are being dealt in at about 6d premium. An issue of 6 per cent redeemable convertible preference shares at par is also being made.

Murex Statement

In raising the interim dividend last month from 5 to 6 per cent, the directors of Murex took the opportunity to report on progress over the first half of the financial year concluding next April. Trading results up to the end of October, it was stated, compared well with the rate of earnings for the previous year, disregarding fortuitous profits; and the group, notably so far as the Murex Welding Processes subsidiary is concerned, is finding it difficult to meet demands because of the raw materials problem. Although well below their recent best, Murex £1 ordinary shares at 53s have been holding their own better than many others during the post-Election depression, and they continue to command an investment rating above the average. Witness to this is the yield of under 4¾ per cent, from the 12½ per cent dividend paid last time.

Capital for E.M.I.

References at the recent annual meeting to the question of raising fresh capital for Electric & Musical Industries has produced the now customary reaction in the price of the existing 10s shares, which have declined to 18s. As frequently mentioned in these notes over the past few months, news of this sort, with its implication of "rights" to be sold by holders unable, or unwilling, to subscribe new money, is coming to be the occasion for an almost automatic marking-down of shares concerned. Reasons given by Sir Alexander Aikman for the proposal, which is not yet detailed but is the subject of an application already made to the Treasury, are the increasingly usual ones associated with the greater working capital required by expanding activities, with a consequent increase in temporary borrowing, and the need for more permanent financial arrangements.

Electrical Investments

Past Month's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price Dec. 28 1951	Month's Rise or Fall	Est. Yield £ s. d.
Overseas Electricity Companies					
Atlas Elec. ..	3	4	19/9	−3d	4 1 0
Calcutta Elec. ..	6†	6†	20/-	−⅛	6 0 0†
Cawnpore Elec. ..	—	—	30/9	−1/9	—
East African Power	7	7	33/6	−6d	4 3 7
Jerusalem Elec. ..	—	—	10/-	—	Nil
Madras Elec. ..	—	—	27/6	−1/-	—
Nigerian Elec. ..	10	10	29/-	−1/-	6 18 0
Palestine Elec. "A"	5†	5†	16/6	−6d	6 1 3†
Perak Hydro-Elec.	Nil	Nil	11/6	−6d	—
Equipment and Manufacturing					
Aberdare Cables(5/-)	20	20	13/9	—	7 5 6
Aron Elec. Ord. ..	15	15	40/-	−2/6	7 10 0
Assoc. Elec. Ord.	15	20	83/9	−⅛	4 15 3
Automatic Tel.&El.	12½	15	63/9	−4/6	4 14 4
Babcock & Wilcox	15	18	70/6	−2/-	5 2 3
Baldwin, H. J. (2/-)	25	25	5/-	−3d	10 0 0
British Aluminium	10	10	39/3	−2/3	5 2 0
B.I. Callender's ..	6¾	7½	30/-	−3/-	5 0 0
British Thermostat (5/-)	30	30	31/3	−⅛	4 16 0
British Vac.Cleaner (5/-)	20	25	15/3	−⅛	8 4 0
Brush Ord. (5/-) ..	10	10	6/-	−6d	8 6 8
Burco (5/-) ..	42½	38¾	21/3	−⅛	9 2 4
Chloride El.Storage	12½	15	62/6	−2/6	4 16 2
Cole, E. K. (5/-) ..	20	25	18/-	−6d	5 11 0*
Cossor, A. C. (5/-)	Nil	Nil	14/-	−6d	—
Crabtree (10/-) ..	17½	17½	34/6	−3/-	5 1 5
Crompton Parkinson Ord. (5/-) ..	22½	11¼*	10/-	−1/-	5 12 6
De La Rue (5/-) ..	50	50	30/9	−1/9	8 2 8
Decca (1/-) ..	112½	112½	17/-	−2/6	6 7 0
E.M.I. (10/-) ..	8	12	18/-	−2/-	6 13 4
Electrical Components (5/-) ..	20	20	11/3	−9d	8 17 10
Elec. Construction	15	15	57/6	−6/3	5 4 2
Enfield Cable Ord.	7½	7½	27/6	−2/6	5 9 1
English Electric ..	10	15	58/9	−⅛	5 2 0
Ericsson Tel. (5/-)	20†	22½†*	42/-	−⅛	2 14 3†
Ever Ready (5/-) ..	35	35	28/-	−1/-	6 5 0
Falk Stadelmann	15	15	41/3	−3/9	7 5 8
G.E.C. Ord. ..	17½	22½	91/6	+1/-	4 18 4
General Cables (5/-)	38	30*	17/6	−9d	8 11 6
Greenwood & Batley	15	15	49/6	−1/-	6 1 6
Hackbridge Cable (5/-)	20	20	10/9	−6d	9 6 0
HackbridgeHewittic (5/-)	15	18	16/3	−9d	5 11 7
Hall Tel. Acc.(10/-)	10	10	12/-	−1/6	8 6 8
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (5/-) ..	20	20	21/-	—	4 15 3
Hoover (5/-) ..	45	30*	27/3	−3/6	5 10 1
Intl. Combustion (5/-)	21	20*	18/9	−1/9	5 6 8
Johnson & Phillips	15	15	56/3	−2/3	5 5 8

Company	Dividend Previous	Dividend Last	Middle Price Dec 28 1951	Month's Rise or Fall	Est. Yield £ s. d.
Equipment and Manufacturing (continued)					
Lancashire Dynamo	22½	22½	43/9	−3/9	5 2 9*
Laurence,Scott(5/-)	12½	12½	12/3	−6d	5 2 3
London Elec. Wire	10	10	42/6	−3/9	4 14 1
J. Lucas	17½	7½*	36/3	−9d	4 2 9
Mather & Platt ..	11	12½	43/9	+6d	5 14 2
Metal Industries ..	10	10	39/-	−2/-	5 2 7
Mid. Elec. Mfg. ..	12½	15	60/-	−5/-	5 0 0
Murex	10	12½	53/-	−½	4 14 4
Newman Ind. (2/-)	10	6	2/9	—	—
Oldham & Son (1/-)	30	30	4/3	−6d	7 1 2
Parsons, C. A. ..	15	15	50/-	−½	3 0 0*
Plessey (5/-) ..	20	22½	16/3	−3/9	6 18 6
Pye Deferred (5/-)	35	18*	19/-	−½	4 14 9
Radio & Tel. (2/-)	—	—	9d	—	Nil
Revo (10/-) ..	27½	27½	40/9	−⅛	6 15 0
Reyrolle	15	15	43/-	+1/9	3 9 9*
Scophony Baird (1/-)	—	—	1/3	−1½d	Nil
Scot. Cable (4/-) ..	30	30	20/-	−4/-	6 0 0
Siemens Ord. ..	7½	10	39/6	−3/-	5 1 3
Switchgear&Cowans (5/-)	20	22½	15/-	−⅛	7 10 0
T.C.C. (10/-) ..	15	20	43/9	—	4 11 4
T.C. & M. ..	9*	10*	38/9	−⅛	5 3 3
TelephoneMfg.(5/-)	10	10	9/-	—	5 11 1
Thorn Elec. (5/-)..	20	10*	9/-	−1/-	5 11 1
Tube Investments	25	25	5½	−7/6	4 11 0
Vactric (5/-) ..	Nil	Nil	8/3	+3d	Nil
Veritys (5/-) ..	2½	Nil	3/9	—	Nil
Walsall Conduits (4/-)	70	70	56/3	−5/-	4 19 0
Ward & Goldstone (5/-)	44	45*	41/6	—	5 8 5
Watford (2/-) ..	20	25	6/3	−6d	8 0 0
Westinghouse Brake	14	14	53/9	−5/-	5 4 0
West, Allen (5/-)..	10	12½	10/9	−6d	5 16 3
Transport and Communications					
Anglo-Am. Tel.: A Ord.	—	—	90½	−3	—
Ord.	—	—	60	−5	—
Anglo-Portuguese	8	8	22/6	−1/6	7 2 3
Brit.Elec.Traction: Def. Ord. ..	22½	25	435	−20	5 15 0
Cable & Wireless: Ord.	—	6	117½	—	5 2 2
4% Loan ..	4	4	95	−3	4 4 3
Calcutta Trams ..	6†	6†	25/6	−1/-	4 14 1†
Cape Elec. Trams	4	5	15/6	−6d	6 9 0
Globe Tel. & Tel. Ord.	—	—	26/-	+1/-	5 7 8
Great Northern Tel. (£10)	7½	8	10½	−¾	7 12 5
Inter. Tel. & Tel.	Nil	15cts	32	−2	—
Marconi Marine ..	7½	10	37/6	+⅛	5 6 8
Oriental Tel. Ord.	16	16	47/6	−⅛	—
Telephone Props.	7	8	33/9	−⅛	4 14 8
Tele. Rentals (5/-)	10	10	9/-	−6d	5 11 1

* After capital bonus.
† Dividends are paid free of Income Tax.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) will be obtainable after 13th February from the Patent Office, 25, Southampton Buildings, London, W.C.2.

46

29546. Standard Telephones & Cables, Ltd., and Reeves, A. H.—Gaseous electric discharge device and circuits therefor. 26th September, 1947. (666394.)

47

3290. Western Electric Co., Inc.—Electron-emitters for electron discharge devices. 4th February, 1947. (666680.)

25930. Wheeler, L. K.—Apparatus for selectively controlling circuits for example keyboard-actuated coding apparatus. 24th September, 1948. (666314.)

27633. Igranic Electric Co., Ltd.—Electrical contact members. 15th October, 1947. (666477.)

27745. Igranic Electric Co., Ltd.—Electrical contacts. 16th October, 1947. (666478.)

28371. British Thomson-Houston Co., Ltd.—Magnetic induction accelerators. 23rd October, 1947. (666479.)

28893. Radio Corporation of America.—Apparatus for the transmission and reception by electrical means of visual images in colour. 29th October, 1947. (666480.)

29716. Radio Corporation of America.—Colour television transmitter. 7th November, 1947. (666481.)

29718. Radio Corporation of America.—Combined polychromatic and monochromatic television system. 7th November, 1947. (666482.)

31972. Staatsbedrijf der Posterijen Telegrafie en Telefonie.—Systems for nullifying the effects of mutilated signals in electrical telegraph systems. 31st December, 1947. (666316.)

1948

118. Triggs, W. W. (Faximile, Inc.).—Facsimile synchronizing signal generator. 2nd January, 1948. (666485.)

2607. Compagnie Générale de Télégraphie sans Fil.—Diode associated with a tunable cavity coupled to a guide. 28th January, 1948. (666318.)

1134. Apex Electrical Manufacturing Co.—Centrifugal dust separators. 12th February, 1948. (666488.)

5959. Director of the Office of Technical Services, Department of Commerce.—Thermionic valve amplifiers. 27th February, 1948. (666489.)

5992. Director of the Office of Technical Services, Department of Commerce.—Tuning and strapping mechanism for u.h.f. magnetrons. 27th February, 1948. (666559.)

6279. Kalmus, H. P.—Amplification of minute space currents and photo-electric cells. 28th February, 1948. (666632.)

8160. Wilson, R. A.—Radio-frequency inductance coils. 11th March, 1949. (666321.)

13991. British Thomson-Houston Co., Ltd., Liddiard, H. W. C., Petch, T. H., and Rolfe, E.—Control of electrically-operated winding or like mechanisms. 24th May, 1949. (666561.)

21419. Igranic Electric Co., Ltd.—Roll winding apparatus. 13th August, 1948. (666569.)

21849. Thorn Electrical Industries, Ltd., Strange, J. W., Waigh, D. T., and Bloxsidge, W. R.—Electric discharge lamp circuits. 13th September, 1949. (666403.)

25633. British Thomson-Houston Co., Ltd.—Electrically-heated flat irons. 1st October, 1948. (666326.)

26103. Laffon y Soto, A., and Sekas y Marin, E. de.—Electro-dynamic oscillograph. 11th October, 1948. (666493.)

26106. Hasler Akt.-Ges. Werke für Telephonie und Präzisionsmechanik.—Directional microphones. 11th October, 1948. (666491.)

27008. Harnischfeger Corporation.—Speed controlling means for alternating current motors. 18th October, 1948. (666497.)

27453. Standard Telephones & Cables, Ltd., Robertson, J. S. P., and Meed, H. R.—Electromagnetic vibratory devices. 22nd October, 1948. (666498.)

29613. British Thomson-Houston Co., Ltd., and Melville, W. S.—Use of saturable magnetic chokes as discharge devices. 6th December, 1949. (666574.)

29614. British Thomson-Houston Co., Ltd., and Melville, W. S.—Pulse generating circuits. 15th November, 1949. (666575.)

29619. Automatic Electric Laboratories, Inc.—Automatic exchange systems. 15th November, 1948. (666500.)

32867. British Thomson-Houston Co., Ltd.—Electric heating devices and control therefor. 20th December, 1948. (666502.)

1949

621. Prima Industries, Ltd., and Bloom, J. L.—Electric generators. 3rd November, 1949. (666469.)

859. Metropolitan-Vickers Electrical Co., Ltd.—Thermal cut-outs for electrically-heated utensils. 7th February, 1950. (666411.)

1365. Ferranti, Ltd., McCallum, D. M., and Gent, H.—Apparatus for the measurement of the velocity of a moving body with respect to its surrounding medium. 27th March, 1950. Cognate applications 13608, 21st May, 1949, and 25719, 6th October, 1949. (666413.)

1366. Ferranti, Ltd., and McCallum, D. M.—Electric spark discharge devices. 18th January, 1950. (666414.)

1611. E.M.P. Electric, Ltd., and Humphreys, I. Y.—Electric fuse incorporating an electric current responsive tripping or actuating device. 12th April, 1950. (666412.)

3445. Metropolitan-Vickers Electrical Co., Ltd.—Geared compound steam turbine plant. 6th February, 1950. (666333.)

8357. Suchy Holdings, Ltd., McAuley, D. J., Richards, H. E. G., and Clark, E. W.—Radar reflectors. 23rd February, 1950. (666335.)

9823. Bloom, H.—Electric lampholders. 11th April, 1950. (666336.)

10616. British Thomson-Houston Co., Ltd., and Ludbrook, L. C.—Electrical remote angular position control systems. 21st April, 1949. (666594.)

12555. Minnesota Mining & Manufacturing Co.—Methods of duplicating magnetic recordings, the elongated magnetic record members resulting from said method and apparatus for duplicating magnetic recordings from a master tape. 11th May, 1949. (666653.)

12590. Noris Zund-Licht Akt.-Ges.—Magneto-electric machines. 11th May, 1949. (666431.)

13080. Hoover, Ltd.—Suction cleaners. 17th May, 1949. (666338.)

13483. Miller, H. F.—Radio receiving apparatus. 20th May, 1949. (666654.)

13559. General Electric Co., Ltd., Cottis, F., and Davies, C. E.—Electric sockets. 15th May, 1950. (666517.)

13560. General Electric Co., Ltd., and Rooksby, H. P.—Thermionic cathodes. 5th May, 1950. (666518.)

13649. Ferranti, Ltd., and Dean, J.—Circular indicating instruments. 23rd May, 1950. (666432.)

14027. General Electric Co., Ltd., and Hill, R. T.—Cathode-ray tube envelopes. 16th June, 1950. (666520.)

14108. Sperry Products, Inc.—Method of and apparatus for transmitting longitudinal waves into an object. 26th May, 1949. (666521.)

14413. Compagnie Industrielle des Téléphones.—Frequency-divider and multiplier systems. 30th May, 1949. (666339.)

14750. Hailwood & Ackroyd, Ltd., and Woodhead, C.—Electric lighting fittings. 1st June, 1950. (666655.)

15934. Honegger, W.—Contact pins for electrical plugs. 15th June, 1949. (666607.)

15957. British Thomson-Houston Co., Ltd.—High-frequency amplifier neutralizing systems. 15th June, 1949. (666436.)

16461. Napier & Son, Ltd., D., and English Electric Co., Ltd.—Electric heating of surfaces. 26th July, 1950. (666609.)

16579. Research Corporation.—Electrostatic precipitators. 22nd June, 1949. (666656.)

16893. Prima Industries, Ltd., and Collins, A.—Electric generators. 20th June, 1950. (666439.)

17224. Metropolitan-Vickers Electrical Co., Ltd.—Optical radiation pyrometers. 24th May, 1950. (666523.)

17265. Mallory Batteries, Ltd.—Rechargeable electric cell. 29th June, 1949. (666343.)

18092. Bendix Home Appliances, Inc.—Washing machines. 8th July, 1949. (666347.)

18918. Lord, R. E. C., and Side, G. A.—Apparatus for automatically stopping an alternator upon removal of its load. 18th July, 1949. (666350.)

19204. Crabtree & Co., Ltd., J. A., and Crabtree, J. A.—Electric lampholders. 6th July, 1950. (666660.)

19599/0. Cinema-Television, Ltd., and Freeman, G. S. P.—Television pick-up tubes or the like. 24th July, 1950. (666526 7.)

20742. Enfield Cables, Ltd., Sutton, C. T. W., and Hankins, W. E.—Joints for stranded electric cables. 6th October, 1950. (666667.)

21165. Allday & Son (1922), Ltd., H., and Bain, R.—Snap-action electric switches. 3rd August, 1950. (666668.)

22033. British Thomson-Houston Co., Ltd.—Protective systems for high-frequency generators. 24th August, 1949. (666671.)

23280. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Control circuits for use in automatic exchange systems. 8th September, 1949. (666445.)

24760. Ericsson Telephones, Ltd., Mitchell, J. E., Distin, L. S., and Wilman, C. V.—Converting circuits for alternating-current supply systems. 21st September, 1950. (666365.)

26465. Preparation Industrielle des Combustibles.—Electrical level indicating devices. 14th October, 1949. (666451.)

26609. General Electric Co., Ltd., and Garthwaite, F. C.—Means for securing a flat plate to a flat surface. 5th September, 1950. (666620.)

27133. Metropolitan-Vickers Electrical Co., Ltd.—Power plant. 29th September, 1950. (666453.)

27429. General Electric Co., Ltd.—Ultra-high-frequency radio signalling systems. 4th October, 1950. (666455.)

27750. Sperry Corporation.—Control apparatus for automatic pilots for aircraft. 31st January, 1946. (666540.)

29957. General Electric Co., Ltd., and Cormack, A.—Electrical oscillation generators. 25th October, 1950. (666464.)

30103. Ferranti, Ltd., and Heaps, J. G.—Electronic voltage stabilizers. 20th February, 1951. (666465.)

30368. Soc. Marocaine Technique et Commerciale.—Method and apparatus for welding by means of electromagnetic induction heating. 26th November, 1949. (666381.)

30569. Radio Corporation of America.—Fine mesh screen type insulator electrodes and the method of making the same. 29th November, 1949. (666382.)

30594. Compagnie Générale de Télégraphie sans Fil.—Capacitors. 29th November, 1949. (666467.)

31042. British Thomson-Houston Co., Ltd., and Melville, W. S.—Pulse generating circuits. 2nd December, 1949. (666624.)

31567. Kalmus, H. P., and Striker, G. O.—Amplification of minute space currents. 28th February, 1948. (666678.)

1951

6591. Thorn Electrical Industries, Ltd., Strange, J. W., Waigh, D. T., and Bloxsidge, W. R.—Electric discharge lamp circuits. 13th September, 1949. (666470.)

Amended Specification

581603. Dippy, R. J.—Wireless systems for navigation.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated:

19th January

CUTLER-HAMMER.—No. 661,665. Class 9. Electrical apparatus for use in controlling the flow of current to machines, engines and motors; and motor starters being electrical switchgear (not parts of machines), lifting and separating magnets (electric), electric switches, rheostats, electric relays, electric contactors, electric switch and control panels, and solenoids, all being goods for sale in the counties of Middlesex, Yorkshire, Gloucestershire, Northumberland, Staffordshire, Surrey, Hertfordshire, Wiltshire, Cheshire, County of Durham, Essex, Oxfordshire, Northamptonshire, Lincolnshire, and in Wales and Scotland.—Cutler-Hammer, Inc., Milwaukee, Wisconsin, U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5–9, Quality Court, Chancery Lane, London, W.C.2.

VAPOTRON.—No. 700,240. Class 9. Electron-discharge tubes (not for lighting purposes).—Compagnie Française Thomson-Houston, Paris, France. Address for service, c/o Baron & Warren, 16, Kensington Square, London, W.8.

28th January

AERIALITE. No. 665,435, Class 9. Copper aerials, and earth tubes and rods and parts and fittings, batteries, microphones, loudspeakers, transformers, cables, lightning arrestors, connector boxes, telephone and meter leads, suppressors, high tension eliminators, trickle chargers, voltmeters, milliammeters and short wave coils, all being goods for use in wireless and telephony and included in Class 9.—Aerialite, Ltd., Castle Works, Stalybridge, Ches.

REDWING. No. 699,644, Class 9. Electrical instruments and apparatus included in Class 9; apparatus for use in radio reception and transmission, television, sound producing, reproducing, recording, receiving, transmitting, and amplifying; scientific, photographic, cinematographic, and optical apparatus and instruments; accounting machines, adding machines, calculating machines, cash registers, and dictating machines; mechanical signs, luminous signs; altimeters; coin-freed automatic machines, coin-freed apparatus; electric cleaning and sweeping apparatus included in Class 9, electric polishing machines for domestic use, fire alarms; measuring, weighing, checking (supervision), life saving, and teaching apparatus and instruments; and parts included in Class 9 of all these goods.—Redwing, Ltd., 340, Bensham Lane, Thornton Heath, Croydon, Surrey.

BERCOSTAT. No. 701,555, Class 9. Toroidally wound rheostats and potentiometers.—British Electric Resistance Co., Ltd., Ohmic Works, Queensway, Ponders End, Middlesex.

GYROMAX. No. 702,687, Class 10. X-ray tubes and housings therefor, all used for therapeutic and diagnostic purposes.—Newton Victor, Ltd., 15–19, Cavendish Place, London, W.1.

STRONG MOGUL. No. 695,511, Class 11. All goods included in Class 11.—Strong Electric Corporation, Toledo, Ohio, U.S.A. Address for service, c/o McKenna & Co., 12, Whitehall, London, S.W.1.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—BRISBANE.—25th January. City Council. Electrical control switchboards and equipment for Tennyson power house. (C.R.E. (I.B.) 78318/51. Ten/3389.)*

Barrow-in-Furness. — 23rd January. British Electricity Authority. Repairing of concrete cooling tower at power station. (See this issue.)

Belfast.—1st February. Electricity Department. Three-phase 33 kV oil immersed reactor. 15th February. Chlorinating plant. (See this issue.)

Brazil.—CUIABA.—10th February. Municipal Power Co. Plant including two turbines, two 849 kVA generators, booster substation, transformer substation, and 90 km of 33 kV transmission lines for a hydro-electric power plant on the Rio da Casca. (C.R.E. (I.B.) 78614/51. Ten/78614/51.)*

Durham.—County Council. Electrical installation at Durham New Grammar Technical School. (See this issue.)

India.—TRIVANDRUM.—2nd February. Government of Travancore-Cochin Stores Purchase Committee. Meters and measuring instruments. (C.R.E. (I.B.) 78223/51. Ten/3376.)*

New Zealand.—AUCKLAND.—4th February. Auckland Electric Power Board. Supply of 6,750 yd of e.h.v. cable with accessories. (C.R.E. (I.B.) 78353/51. Ten/3388.)*

WELLINGTON. Post Office. Flameproof wire. (C.R.E. (I.B.) 78633/51. Ten/3404.)*

State Hydro-Electric Department. 1st April. Supply of one 20,000 kVA transformer bank and spare unit for Haywards substation. (C.R.E. (I.B.) 78827/51. Ten/3413.)* 8th April. Two 20,000 kVA transformer banks and spare unit for Hamilton substation. (C.R.E. (I.B.) 78860/51. Ten/3412.)*

South Africa. — BLOEMFONTEIN. — 30th January. Municipal Council. Supply of 11 kV and 22 kV switchgear and relay equipment. (C.R.E. (I.B.) 78642/51. Ten/3411.)*

Southern Rhodesia.—11th February. Electricity Supply Commission. Supply of power factor correction capacitors. (C.R.E. (I.B.) 78877/51. Ten/3414.)*

Stoke-on-Trent. — 27th February. City Council. Rewiring of "Westcliffe," Tunstall. (See this issue.)

Uruguay. — MONTEVIDEO. — 5th February. Administracion General de las Usinas Electricas y los Telefonos del Estado. Supply of 6,000 V underground armoured cables and complementary material. (C.R.E. (I.B.) 78483/51. Ten/3386.)* 4th March. Supply of 30 kV armoured cables. (C.R.E. (I.B.) 78481/51. Ten/3395.)*

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

ORDERS PLACED

London.—City Corporation. Recommended. Replacement of internal telephone system at the Mansion House (£1,000, less £150 allowance for old equipment).—Reliance Telephones, Ltd.

Middlesbrough. — Education Committee. Electrical installation at Marton Road School (£1,138).—Haigh & Ringrose, Ltd.

Middlesex.—County Education Committee. Accepted. Electric lighting installation, Tudor Road Infants' School, Southall (£879).—Duncan Mays.

Seaham.—U.D.C. Street lighting equipment for the Westlea estate.—Revo Electric Co., Ltd.

Tamworth (Staffs).—Birmingham Regional Hospital Board. Recommended. Re-wiring of the General Hospital (£3,820).—Baxter & Impey, Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alnwick.—Houses (40) in 1952 for the R.D.C.; T. J. Cahill, architect, Lloyds Bank Chambers.

Barnet. — Junior mixed infants' school, Totteridge, for Herts E.C.; H. G. Cherry, architect, 33, Gordon Square, W.C.1.

Belper.—Houses, Woodlands site (60) and Horsley (8); J. Laycock, R.D.C. surveyor.

Billingham-on-Tees.—Houses (150), Roseberry site, for the U.D.C.; Kitching & Co., architects, 21, Albert Road, Middlesbrough.

Birkenhead.—Single-storey extension to food factory at Canning Street for Norman Foods, Ltd.; E. J. Blakeley & Co., Ltd., Beaufort Works, Beaufort Road, Birkenhead.

Blandford.—Assembly hall, woodwork and metal rooms, kitchens, gymnasium, and three-storey classroom block, for secondary modern school; C. P. Brutton, clerk to Dorset E.C., County Hall, Dorchester.

Boston.—Reconstruction and extensions at General Hospital for Sheffield Regional Hospital Board; W. E. Norman Webster & Son, architects, 1a, Station Street, Spalding.

Bromsgrove.— Houses (60), Charford House estate; R. H. Crump, quantity surveyor, Redditch Road, Holloway, Alvechurch, Birmingham.

Builth.—Conversions at Wyeside, Castle Street, for Council offices and chambers; D. Ll. Thomas, clerk to R.D.C., 5, Broad Street, Builth Wells.

Burton-on-Trent.—Second instalment of Hillside Secondary Modern School; Thos. Lowe & Sons, Ltd., Curzon Street, Burton.

Cannock.—Houses (33), Hilton Lane, Great Wyrley; Gray & Ballinger, architects to R.D.C., 15, Bridge Street, Walsall.

Chatham.—Fire and ambulance stations (£52,845) for Kent C.C.; F. Parham, Ltd., builders, Eva Road, Gillingham, Kent.

Daventry.—Houses (56); R.D.C. surveyor, 44, High Street.

Derby.—Construction of day nursery at St. Mark's Road; C. Hammersley (Little Easton), Ltd., Little Easton.

Dorchester.—Houses (74), Middle Farm estate; L. Magnus Austin, architect, Bowling Alley Walk.

Easington.—Houses (14), Wingate, for R.D.C.; Tomlin & Son, builders, South Crescent, Seaham.

Edgware.—Additional factory building; Boosey & Hawkes, Ltd., Sonorous Works, Deansbrook Road.

Eston.—Houses (348), near Normanby Road; N. C. Harrison, U.D.C. surveyor.

Gateshead.—Houses (100) for Huwood Mining Machinery Co., Ltd., Team Valley Trading Estate, Gateshead.

Hebburn-on-Tyne.—Houses (100) for U.D.C.; R. C. Bestow, surveyor.

Nine shops and flats (£20,988) for U.D.C.; J. M. Black, Ltd., builders, Glen Street, Hebburn.

Higham Ferrers.—Houses (38) for T.C.; Robert Marriott, Ltd., Rushden.

Loftus.—Houses (62), Mars Farm housing site, for U.D.C.; C. D. Taylor, architect, 41, Baxtergate, Whitby.

London.—CATFORD.—Flats (50), Adelaide Road, for Lewisham B.C.; borough architect.

MAIDA VALE.—R.C. School, Lanark Road; David Stokes, architect, 32, Victoria Street, S.W.1.

TEMPLE FORTUNE.—Block of 12 flats, Finchley Road and Addison Way; Land & Property Trust, 32, Shaftesbury Avenue, W.1.

WANDSWORTH.—Maisonnettes (296), houses (56), aged persons' flats (18), and six shops, Putney Vale estate; R. H. Jerman, town clerk, S.W.18.

Malton (Yorks).—Houses (28), Peasey Hills Road site, for U.D.C.; L. T. Oldfield & Son, Castlegate, Malton.

Mansfield.—Assistant nurses' training school, Victoria Hospital; Sheffield Regional Hospital Board, Fulwood House, Sheffield, 10.

Market Rasen.—Food storage depot, for Ministry of Food; F. A. Would, Ltd., builders, Ladysmith Road, Grimsby.

Newcastle-on-Tyne.—Extensions to General Hospital for Regional Hospital Board (£24,000); Anglo-Scottish Construction Co., Ltd., builders, Gosforth.

New Rutherford Secondary Grammar School for E.C. (£207,000); A. Anderson, Ltd., builders, Stanmore Road, Newcastle.

Fourteen shops and 18 garages on Blakelaw estate for City Council; C. S. Hogg, Ltd., builders, 261, Two Ball Lonnen, Newcastle.

Houses (85), Slatyford Lane, for City Council; Newcastle Federation of Master Builders, contractors.

Newport Pagnell.—Houses for U.D.C. at Bury Field site; H. W. Mason & Son, 34, Silver Street (14 dwellings) and Hy. Mason Junior, 130, High Street (10).

North Riding.—School at Haxby for C.C. (£34,500); county education architect, County Hall, Northallerton.

Nottingham.—Extensions at Wilford Hill crematorium (£15,446); city surveyor.

Peterborough.—Apprentice training school at works; Baker Perkins, Ltd., Westwood Works.

Prudhoe (Northumberland).—Bakery at Crawcrook (£70,000) for West Wylam and Prudhoe Co-operative Society.

Scarborough.—Houses (56), Eastfield; A. Schofield (Builders), Ltd., St. Bedes, Hornsea.

Seaham.—Eight shops and flats on Parkside estate for U.D.C.; Tomlin & Son, builders, South Crescent, Seaham.

Sheffield.—Factory and offices, Hoyle Street; Rigby's (Tilers), Ltd., Reed Street.

Skelton.—Houses (22), Boosbeck, for U.D.C.; Westfield Estates, Ltd., builders, West Terrace, Redcar.

Skipton.—Houses (58); R.D.C. surveyor, Granville Street.

South Shields.—Houses (635) on various sites; borough engineer.

Stalybridge.—Dwellings (40), St. George's estate; Howard & Benson, architects, 88, Mosley Street, Manchester.

Stamford.—Old people's bungalows near Orchard Road, and houses (42); F. J. Lenton & Partners, Broad Street, Stamford.

Stanley.—Houses (200), Catchgate, for U.D.C.; J. R. Heslop, surveyor.

Stockton-on-Tees.—New St. Peter and St. Paul R.C. Primary School (£44,270); Fordy & Son, builders, Boathouse Lane, Stockton.

Sunderland.—Houses (1,200), Grindon; borough architect, Stockton Road, Sunderland.

Infants' school at Pennywell (£60,000) and primary school at Grindon (£80,000); borough architect, Stockton Road, Sunderland.

Swansea.—Crematorium, Morriston Cemetery; borough architect.

Tipton.—Flats (28), Coppice Street; borough engineer.

Uttoxeter.—Houses, Weaver Lodge and Bentley House estates (22); O'Dair Bros., Ltd., Uttoxeter.

Wakefield.—Ambulance depot at Stanley Road (£22,000) and fire service central repair depot at Balne Lane (£18,383); H. Bennett, county architect, Wakefield.